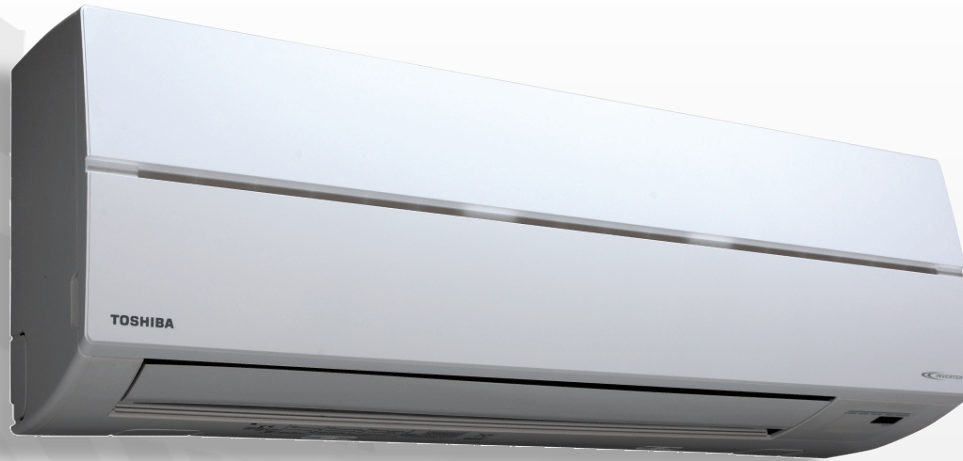


TOSHIBA
Carrier



Toshiba *Carrier* Inverter
Products & Service Training



Installation



Inverter Basic



User Training



Operation



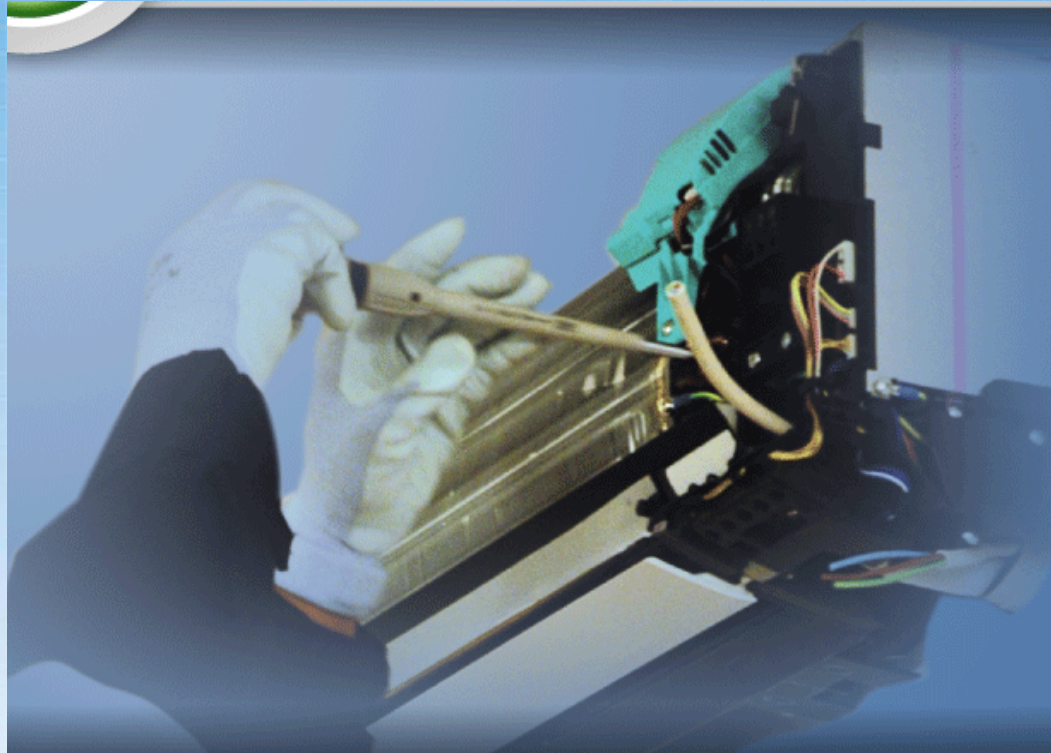
Services



Case Study & FAQ



Select Training



Installation

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back




Next

Product Dimension

FCU :

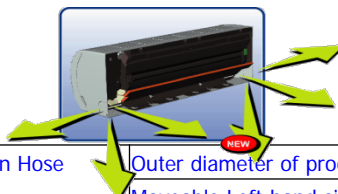
Model	FCU	RAS-09LKV-UL	RAS-12LKV-UL	RAS-15LKV-UL	RAS-17LKV-UL	RAS-22LKV-UL
High	In. (mm.)	10-25/32 (275)		12-19/32 (320)		
Width	In. (mm.)	31-1/8 (790)		41-5/16 (1050)		
Dept	In. (mm.)	25-11/20 (205)		8-15/16 (228)		
Wight -Net	Lbs. (kg.)	20 (9)		29 (13)		
						

CDU :

Model	CDU	RAS-09LAV-UL	RAS-12LAV-UL	RAS-15LAV-UL	RAS-17LAV-UL	RAS-22LAV-UL
High	In. (mm.)	21-11/16 (550)				
Width	In. (mm.)	30-11/16 (780)				
Dept	In. (mm.)	11-7/16 (290)				
Weight - Net	Lbs. (kg)	75 (34)	88 (40)	91 (41)		93 (42)
						



Piping and Drainage Specification

Item		Product Model	FCU	RAS-09LKV-UL	RAS-12LKV-UL	RAS-15LKV-UL	RAS-17LKV-UL	RAS-22LKV-UL
			CDU	RAS-09LAV-UL	RAS-12LAV-UL	RAS-15LAV-UL	RAS-17LAV-UL	RAS-22LAV-UL
Refrigerant type			R410a					
Compressor			DA89X1C-23FZ2		DA111A1-20F1	DA130A1F-27F		DA150A1F-20F
Connecting Pipe	Pipe size.	Liquid pipe (Smaller)	1/4"					
		Gas pipe (Bigger)	3/8"			1/2"		
	Pipe length	Standard Design ft. (m)	16(5)			25(7.5)		
		Min. ft.(m)	6.6 (2)					
		Max. (without add charge) ft. (m)	50 (15)					
		Max. (with add charge)	60 (20)					
		Add charge amount	0.22 oz/ft (20 g/m.)					
Height different (Between FCU & CDU and measure in vertical direction only)			33 ft. (10 m.)					
		Direction-1	Yes					
		Direction-2	Yes					
		Direction-3	Yes					
		Direction-4	Yes					
		Direction-5	Yes					
		Direction-6	Yes					
Drain Hose	Outer diameter of product		16.3 mm.					
	Moveable Left-hand side or Right-hand side		Yes					
Service Valve		Thread	1/2 UNF (20 Threads/Inch)					

Introduction

Installation

User Training

Operation

Services

 Case Study
& FAQ


Home



Back



Next

Electrical Wiring Specification

Item	Product Model	FCU	RAS-09LKV-UL	RAS-12LKV-UL	RAS-15LKV-UL	RAS-17LKV-UL	RAS-22LKV-UL
		CDU	RAS-09LAV-UL	RAS-12LAV-UL	RAS-15LAV-UL	RAS-17LAV-UL	RAS-22LAV-UL
MCA			10.0 A	13.0 A	13.0 A	13.0 A	15 A
Fuse / Circuit Breaker of main power supply			15		20		25
Power Supply Connection.	Connect to FCU/CDU	CDU					
(Power cord is not provide)	No. of Core	3 (L1 , L2 , \perp)					
Inter connecting wire between	No. of Core	4 (L1 , L2 , S , \perp)					
FCU & CDU (Not provide)	Size	14 AWG Minimum					
Conduit size		12.7 mm. or 1/2 inch					

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



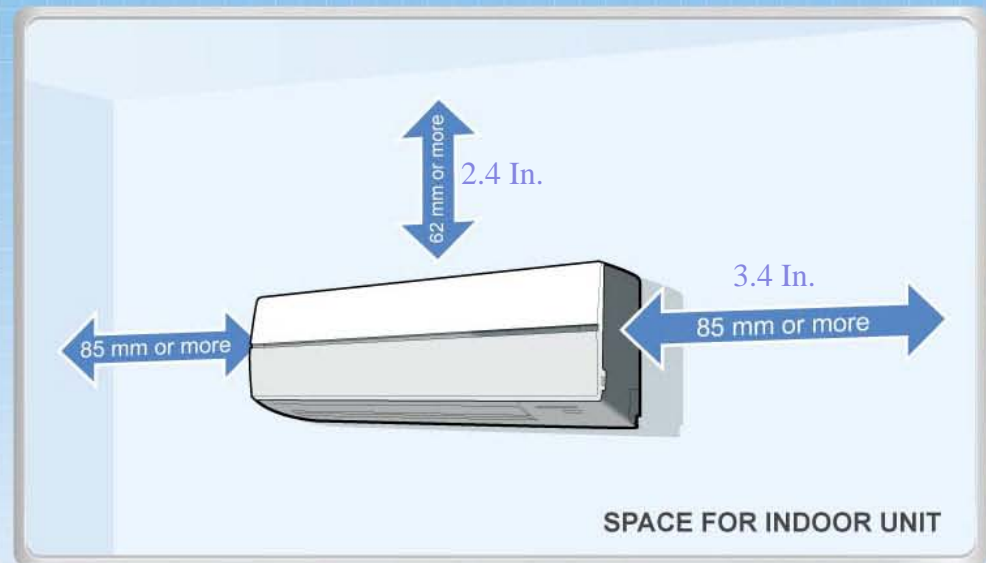
Next

Space for installation

Indoor unit

Install the Indoor & outdoor units without blocking the air discharge to secure an effective operation, and to prevent any capacity decrease and other problems. At least 3 sides should be kept free from the walls.

Also the installer needs to consider whether the connecting point to the outdoors unit can be done easily or not.



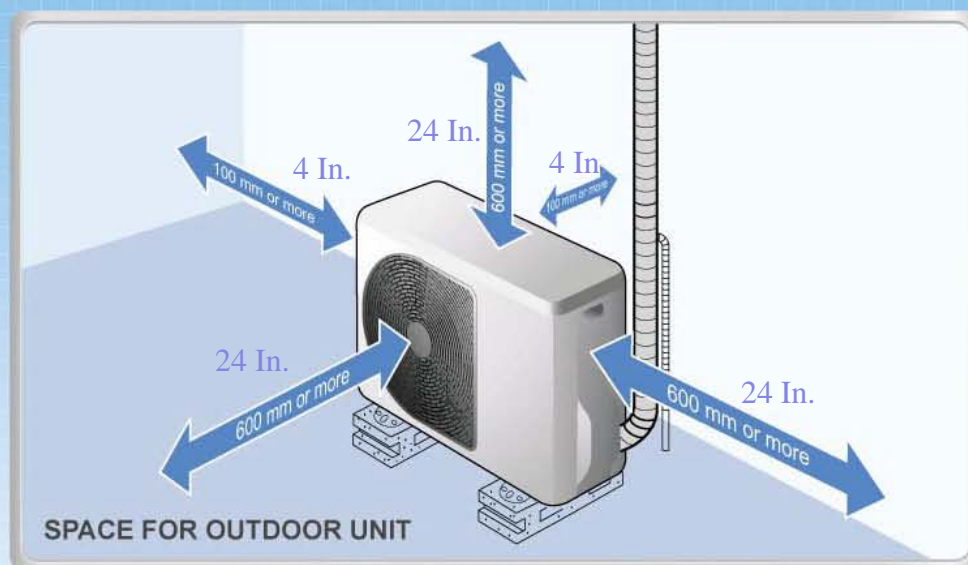
Notes : Clearances shown above are the minimums required for all sizes

[Introduction](#)[Installation](#)[User Training](#)[Operation](#)[Services](#)[Case Study
& FAQ](#)[Home](#)[Back](#)[Next](#)

Space for installation

Outdoor unit

The Outdoor unit needs to be installed in a place where it can be easily serviced. Clearances show are the minimum required.

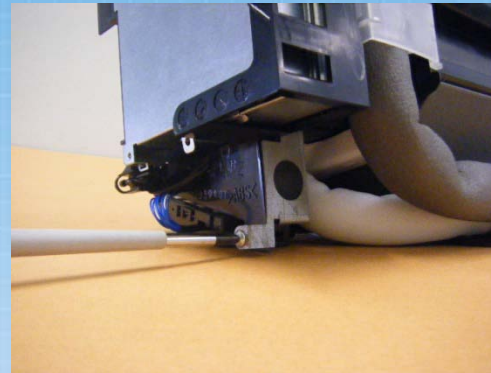


Wiring connection and Conduit Fixing

Indoor unit.



1. Remove the front panel and terminal cover.



2. Remove the mount conduit from the body.



3. Assemble the conduit and connecting cable to the mount conduit.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home

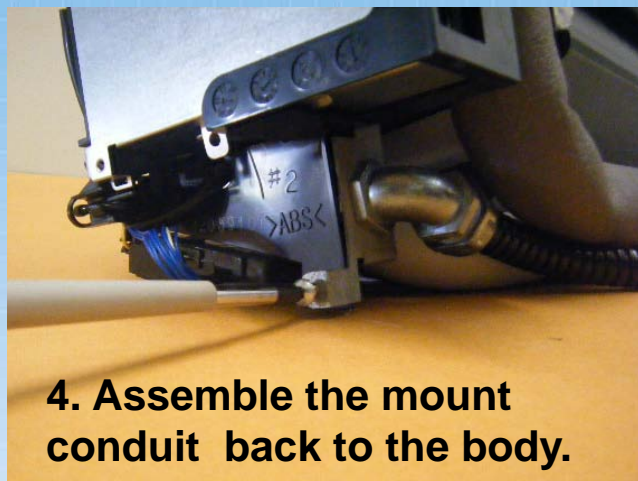


Back

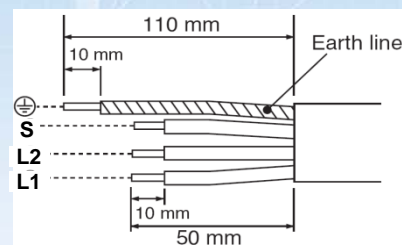


Next

Wiring connection and Conduit Fixing Indoor unit.



5. Connect the connecting wires to the terminal.

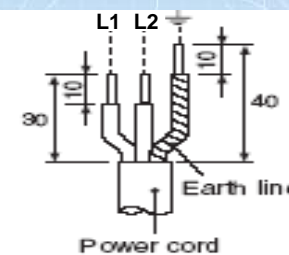
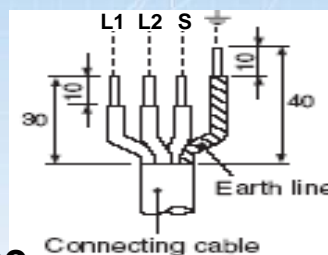


Wiring connection and Conduit Fixing Outdoor unit.



1. Remove the cover and assemble the connecting cable, power cord, and conduits to the mount conduit .

2. Assemble the connecting wires, power wires to the terminal.



Wiring connection and Conduit Fixing Outdoor unit.



3. Assemble the cover when piping work, installation and operation test are finished.

Note : Refrigerant pipes are connect to the outdoor unit in horizontal direction.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

Inverter Basics



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



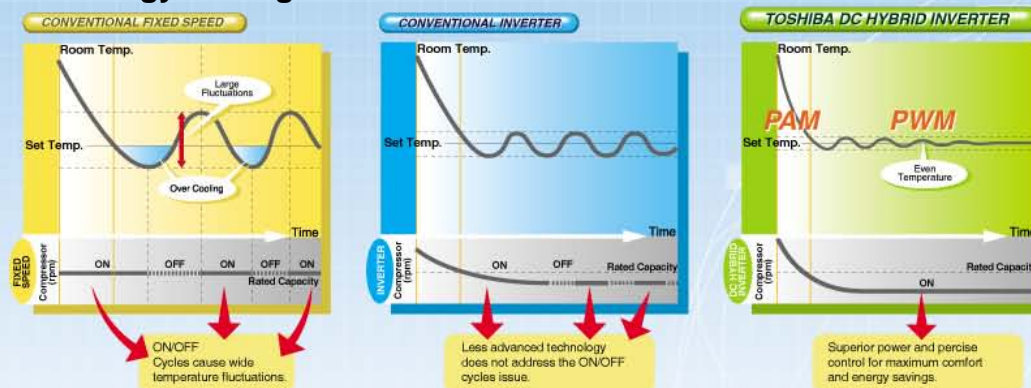
Next

What is Inverter ?

Inverter is the feature that continuously changes the compressor revolution speed by varying frequency or voltage. On the other hand, the inverter can change the frequency input to the motor freely by the electronic control technique to control the motor revolution speed.

As a result, the Inverter air conditioner instantly raises or lowers the temperature of the room by increasing the compressor revolution (speed) at the start of the operation. After the room is heated or cooled, the Inverter gradually lower the compressor of revolution to save capacity and reduce temperature fluctuation in the room.

With a Fixed-speed air conditioner, it takes longer to raise or lower the temperature of the room because the compressor revolution rotates at the same speed throughout. This means that the room tends to be over-heated or over-cooled. Furthermore, when the room temperature reaches the set temperature, the sensor will signal the Fixed-speed compressor to shut off entirely, thereby creating a drastic change in room temperature. This causes discomfort and results in energy wastage.



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

What is Inverter?

- The revolution speed N of the general induction motor is stable.

$$N = \frac{120 f}{P}(1-S)$$

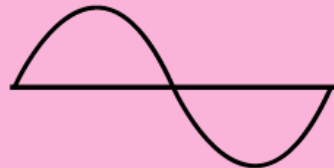
N : rpm

f : Power supply frequency 50 or 60 Hz

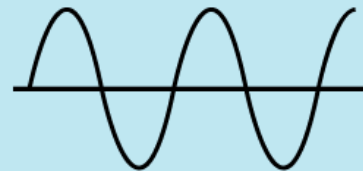
P : Motor pole

S : Slip (Approx. 5%)

- Inverter varies the frequency freely, which is input to the motor to change revolution speed of the motor.



Voltage wave form in
low-speed revolution



Voltage wave form in
high-speed revolution

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home


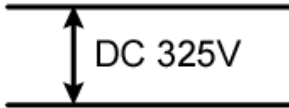




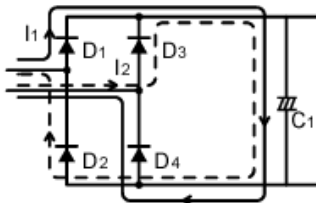
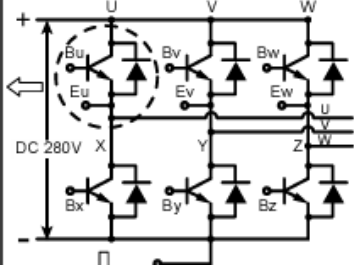



Back



Next

Principle of Inverter

	Power supply	Converter	Inverter	Motor
Wave form	 AC 230V 50/60Hz	 DC 325V	Frequency Low  Middle  High 	
Hard		 Make DC	 Wiring diagram Make AC wave form again.	

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home

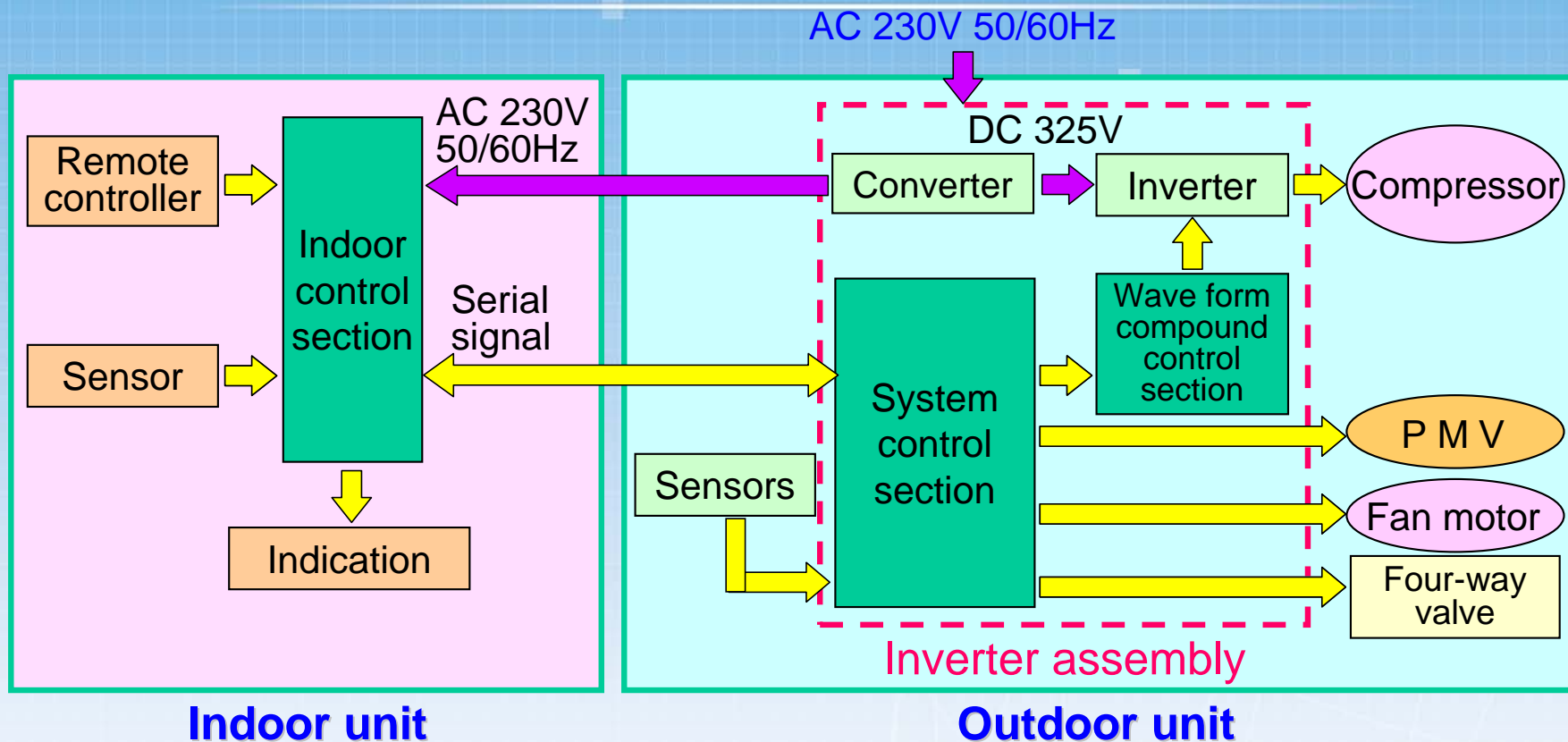


Back



Next

Control Outline of Inverter Air Conditioner



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back

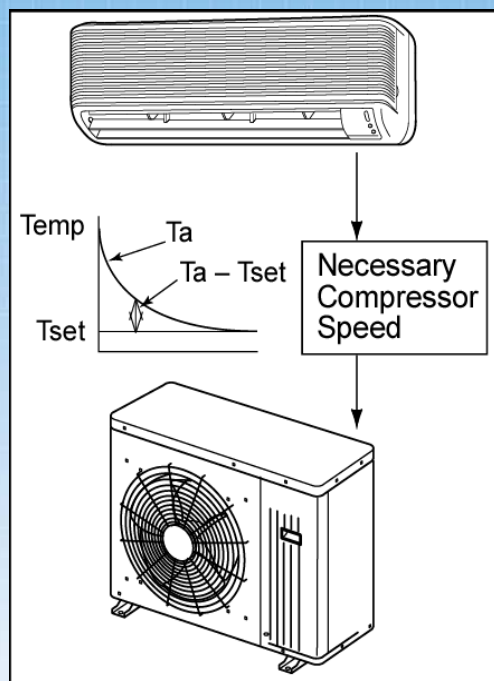


Next

Control Method of Capacity

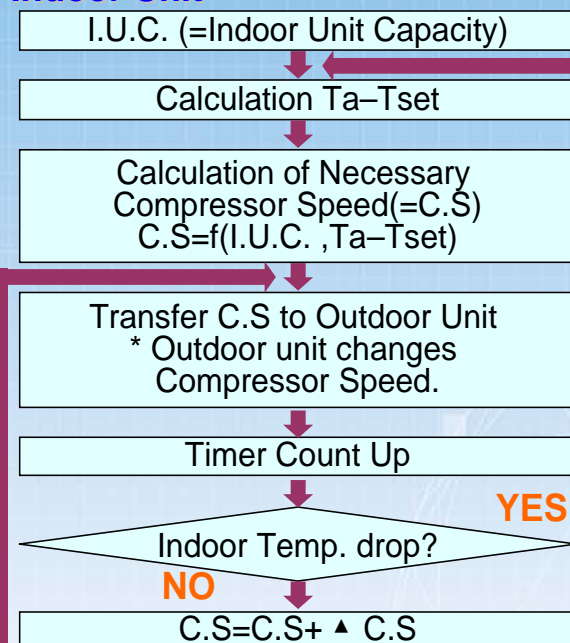
Compressor Revolution Speed

(Explanation on cooling operation)



Fundamental Control

Indoor Unit



Another Control

Indoor Unit

- 1 Prevent-Freezing of Indoor Heat exchanger
- 2 Limit of Maximum Speed by Operation Mode

Outdoor Unit

- 1 Speed Control at Starting (For Reliability)
- 2 Current Release Control
- 3 Discharge Temp. Control
- 4 Limit of Maximum Speed

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

What is Toshiba DC Hybrid Inverter?

Toshiba DC (Direct Current) Hybrid Inverter, the advanced digital technology in air conditioning system, is easily implied as a perfect control of power. It operates to reach maximum power rapidly and also maintains the desired temperature constantly by intelligently varying the electrical current frequency to modulate the rotation of the compressor. As a result, it is the solution that eliminates highly fluctuated temperature that you used to be uncomfortable with.

➤ ***PAM***

Pulse Amplitude Modulation

high power, to ensure the fastest achievement of the setting temperature.

➤ ***PWM***

Pulse Width Modulation

maximizes efficiency, once the temperature has stabilized.

Hybrid = PAM + PWM



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back

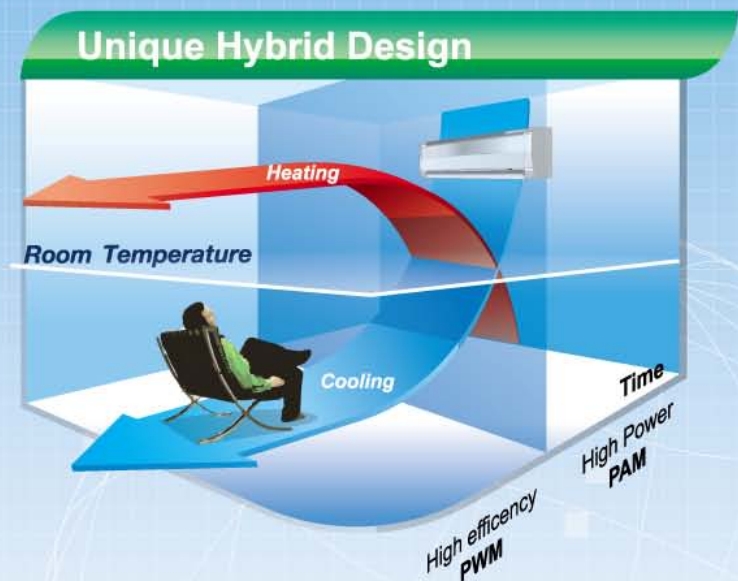


Next

HYBRID INVERTER TECHNOLOGY

How does it work?

Toshiba Digital Hybrid Inverter integrates two distinct control modules to ensure constant natural comfort, instantly achieved with maximum energy efficiency. Upon starting, the Pulse Amplitude Modulation (PAM) module sets a compressor at the maximum power, providing fast cooling or heating in order to achieve the desired room temperature. Subsequently, the Pulse Width Modulation (PWM) module engages automatically to maintain the desired room temperature. This is done by smoothly modulating the compressor capacity to exactly match room load requirements. This results in significantly less energy consumption and higher cost effectiveness.

[Introduction](#)[Installation](#)[User Training](#)[Operation](#)[Services](#)[Case Study
& FAQ](#)[Home](#)[Back](#)[Next](#)

TOSHIBA Advanced Technology

Core technology and contribution to the system

DC twin rotary compressor This compressor enables the adoption of a high - pressure refrigerant. High efficiency is evident in low speed operation ranges. It can reduce energy consumption when operated in a long stable conditions.

➤ High Efficiency

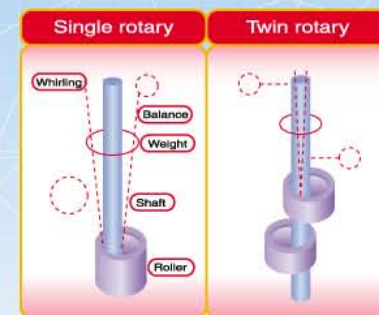
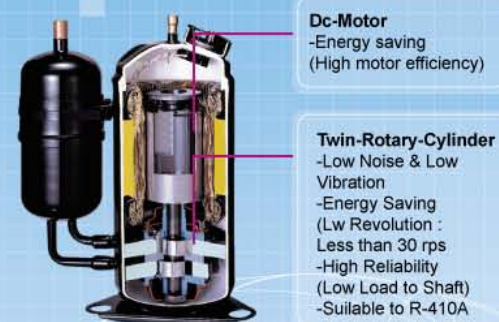
Rotating with two rollers at the same time, makes accurate compressor rotation possible with less energy loss. As a result, it offers a great reduction in energy consumption yet with very powerful operation

➤ High Reliability

Due to the unique double counter- rotating cylinder, accurate rotation is to achieve with high reliability. So, you don't need to worry about frequent maintenance.

➤ Low Noise

Twin rotaries make rotation more stable. The compressor operates by two rollers that ensure a steady rotation rather than a single rotary compressor in order to reduce the unwanted vibration.



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

User Training



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

How to use the Remote control.

How to set/reset basic functions.

**Basic maintenance for users in order
to maintain optimum performance.**

Option can be chosen by trainer

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home




Back



Next

Get Complete Control

The Toshiba remote control is as carefully designed as the rest of the system. Frequently used buttons are placed at the top, while feature buttons are laid out in user-friendly zones.



PRESET
One Touch Preset
Store your desired settings and activate them at the touch of a button.

ONE TOUCH
One Touch My Comfort
Toshiba Carrier has conducted extensive research to assess customer preferences in order to offer a combination of features that are perfect for you.

QUIET
Quiet
The indoor will operate at the lowest noise level. It shifts to super-low fan speed, reducing the sound of the indoor unit by up to 3 dB.

12 AUTO
Swing & Fix Louver
Optimize the airflow direction by selecting from a range of Fixed and Swing louver positions.

REPEAT TIMER
Timer
Set on and off times or program a setting to repeat every 24 hours.

TIMER
Auto Diagnosis
The 26 Code 'Auto Diagnosis' monitors main functions and components for easy maintenance.

TEMPERATURE CONTROL
Temperature control.

FAN SPEED
Fan Speed
Choose one of five fan speeds manually or select Auto Fan Speed to let your air conditioner do the thinking.

OPERATING MODE
Operating Mode
Select from Auto Changeover, Cooling, Drying (dehumidification), Fan Only or Heating.

COMFORT SLEEP
Comfort Sleep
For optimum comfort, set the temperature to rise by 1°C after 1 hour, then another degree after 2 hours, which will be maintained until morning.

ECO
Eco-Logic
Achieve energy-savings of up to 25% compared with standard settings without sacrificing comfort.

HI-POWER
Hi-Power
Extra airflow to rapidly reach your desired temperature setting.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

Get Complete Control

The Toshiba remote control is as carefully designed as the rest of the system. Frequently used buttons are placed at the top, while feature buttons are laid out in user-friendly zones.



One Touch Preset

Store your desired settings and activate them at the touch of a button.



One Touch My Comfort

Toshiba Carrier conducted extensive research to assess customer preferences in order to offer a combination of features that are perfect for you.



Quiet

The indoor unit will operate at the lowest noise level. It shifts to super-low fan speed, thereby reducing the sound of the indoor unit by up to 3 dB.



Temperature control.



Fan Speed

Control your airflow with five fan speeds or select Auto Fan Speed to let your air conditioner do the thinking.

Operating Mode

Select from Auto Changeover, Cooling, Drying (dehumidification), Fan Only or Heating .

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

Get Complete Control

The Toshiba remote control is as carefully designed as the rest of the system. Frequently used buttons are placed at the top, while feature buttons are laid out in user-friendly zones.



Swing & Fix Louver

Choose your optimum airflow by selecting from a range of Fixed and Swing louver positions.



Timer

Set on and off times or program a Setting to repeat every 24 hours.



Auto Diagnosis

The 26 code 'Auto Diagnosis' monitors main functions and components for easy maintenance.



Comfort Sleep

For optimum comfort, set the temperature to rise by 1°C after 1 hour, then another degree after 2 hours, which will be maintained until morning.



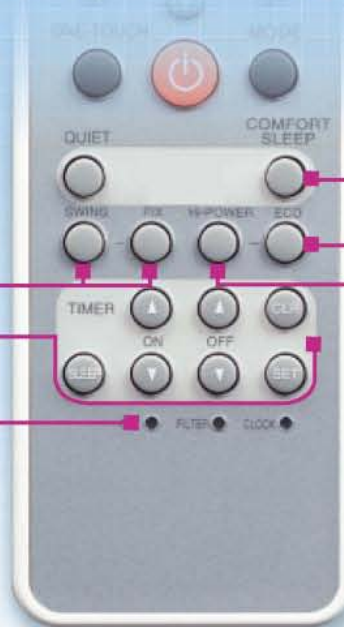
Eco-Logic

Achieve energy-savings of up to 25% compared with standard settings without sacrificing comfort.



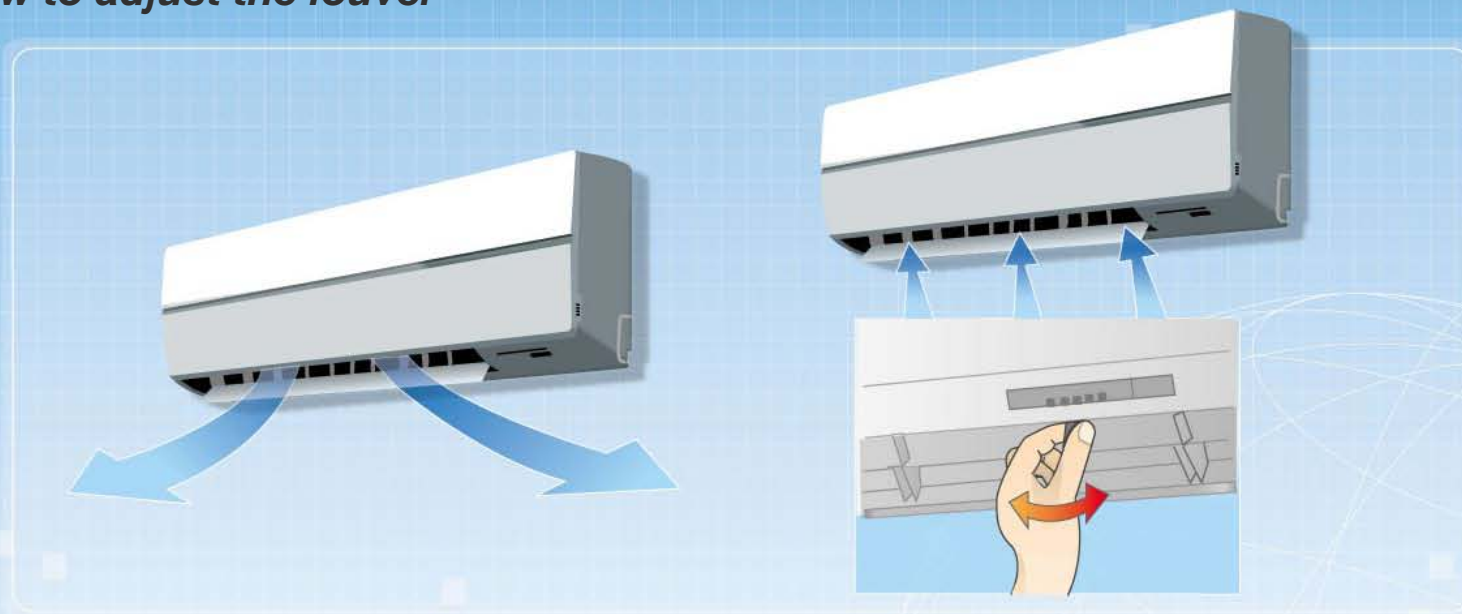
Hi-Power

Extra airflow to rapidly reach your desired temperature setting.

[Introduction](#)[Installation](#)[User Training](#)[Operation](#)[Services](#)[Case Study
& FAQ](#)[Home](#)[Back](#)[Next](#)

How to set/reset basic functions

How to adjust the louver



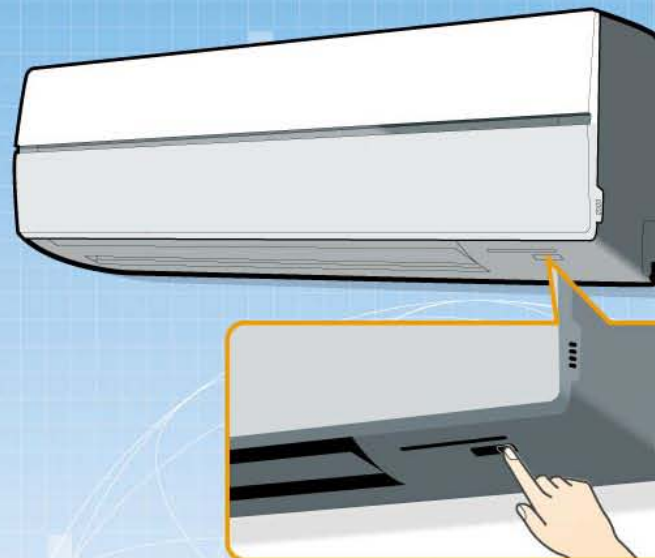
Press the fix button for adjusting the horizontal louver. Press swing to swing and press again to turn off. Vertical louver are adjusted manually.

[Introduction](#)[Installation](#)[User Training](#)[Operation](#)[Services](#)[Case Study
& FAQ](#)[Home](#)[Back](#)[Next](#)

How to reset the filter lamp

A filter lamp illuminates after 1000 hours of operation. This indicates that the filter needs to be cleaned.

After cleaning the filter, reset the filter lamp by pressing down the reset button on the remote control for one second.



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

Operation Description

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back

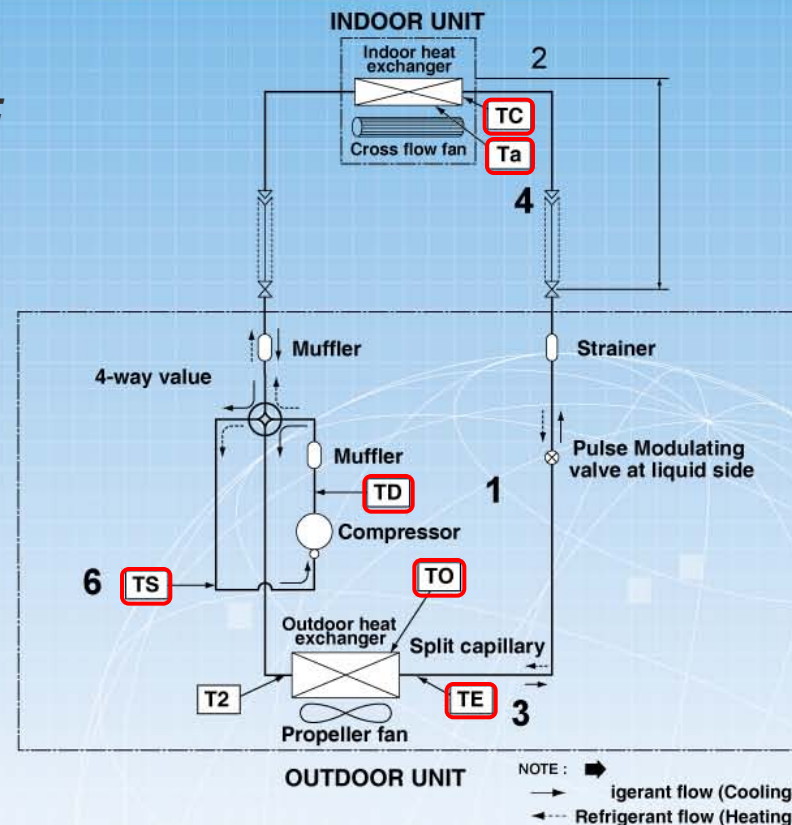


Next

Sensors of Inverter Air Conditioner on the refrigeration cycle

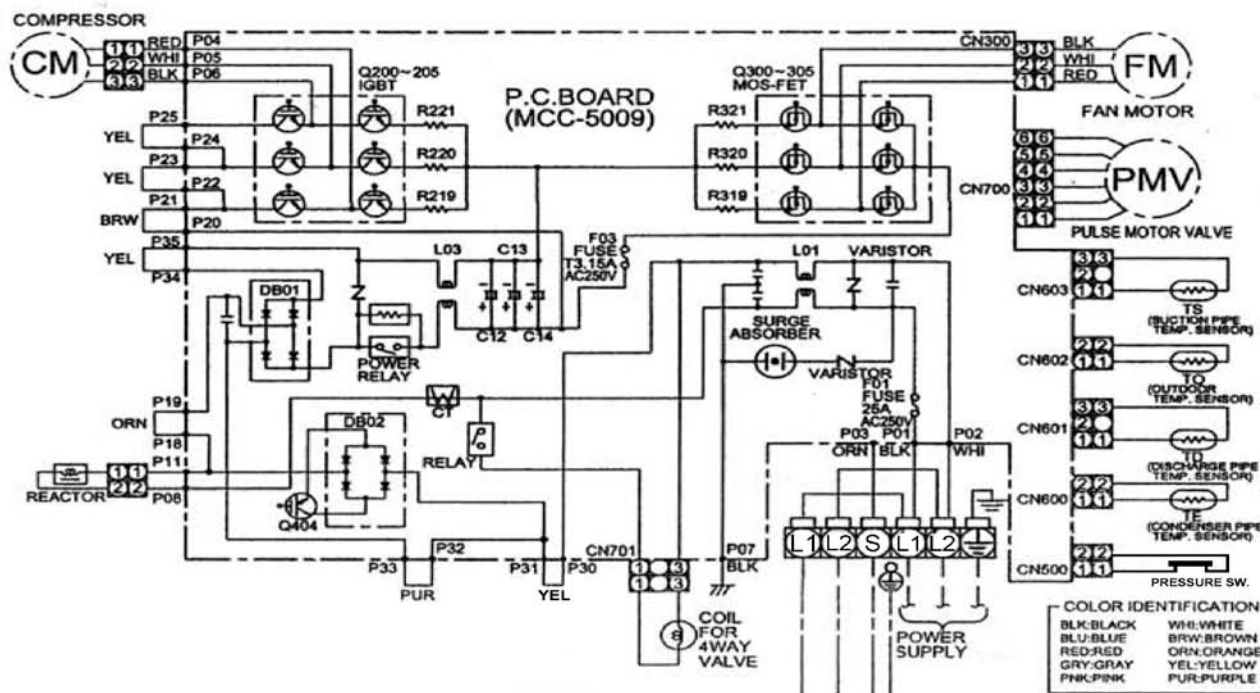
Inverter sensors that installers need to know are;

1. TD sensor which measures the compressor discharge temperature
2. Tc sensor which measures the Indoor unit coil temperature.
3. Te sensor measures the Outdoor unit coil temperature.
4. Ta sensor measures the Room temperature (Return air)
5. To sensor measures the Outdoor temperature.
6. Ts sensor measures the suction temperature to the compressor



Wiring Diagram

CDU : RAS-09LAV-UL



To FCU

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



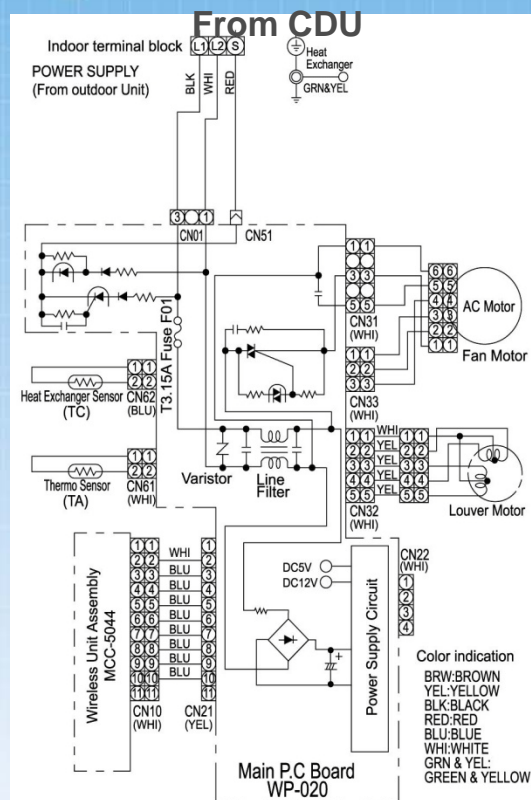
Back



Next

Wiring Diagram

FCU : RAS-09LKV-UL



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



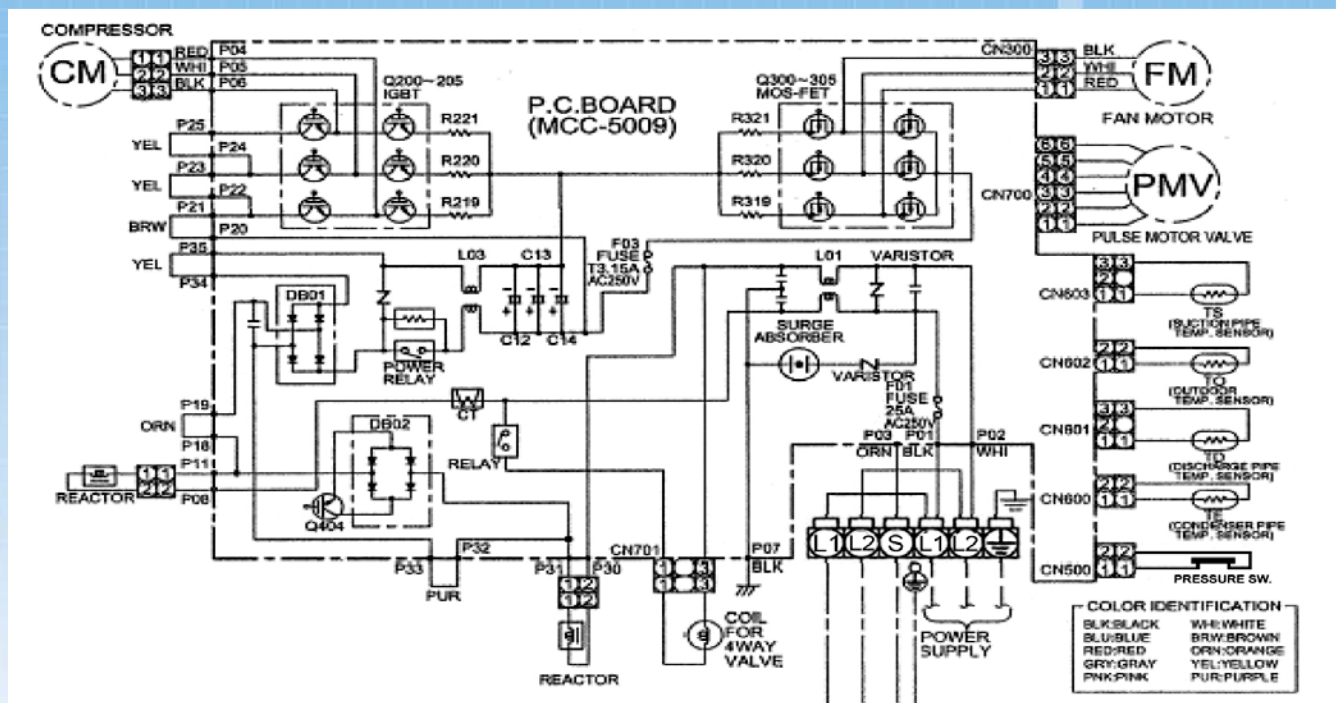
Back



Next

Wiring Diagram

CDU : RAS-12LAV-UL, RAS-15LAV-UL, RAS-17LAV-UL, RAS-22LAV-UL



To FCU

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back

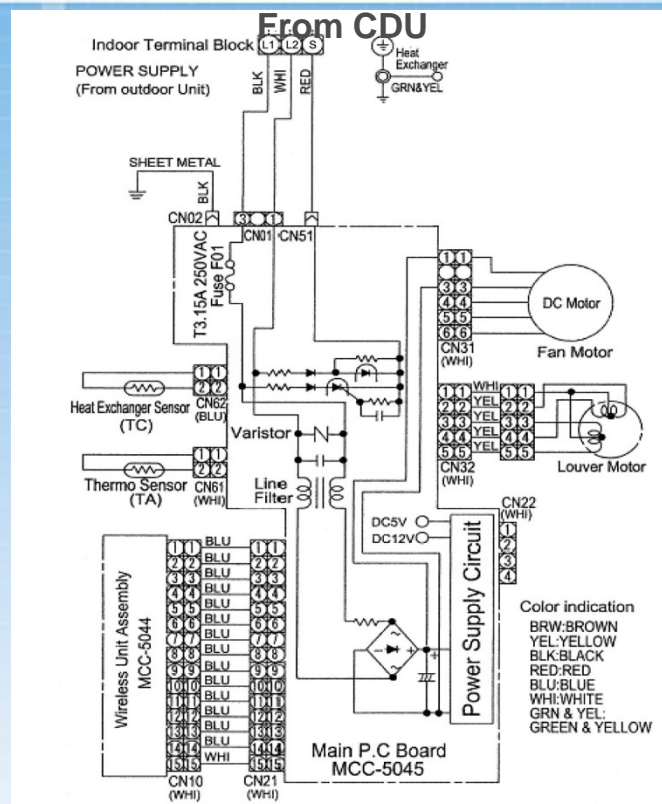


Next

Wiring Diagram

FCU :

**RAS-12LKV-UL,
RAS-15LKV-UL,
RAS-17LKV-UL,
RAS-22LKV-UL**



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

Wiring Diagram : Specifications of Electrical Parts

FCU :

No.	Part Name	Models	Type	Specification
1	Fan Motor	RAS-09LKV-UL	AFN-220-20-4D	AC240V, 20W
		Others	ICF-340U30-2	DC340V, 30W
2	Louver Motor	All	MP24Z3T	DC12V, 1W, 16P
3	Sensors, TA, TC	All	-	10k Ω (25°C)

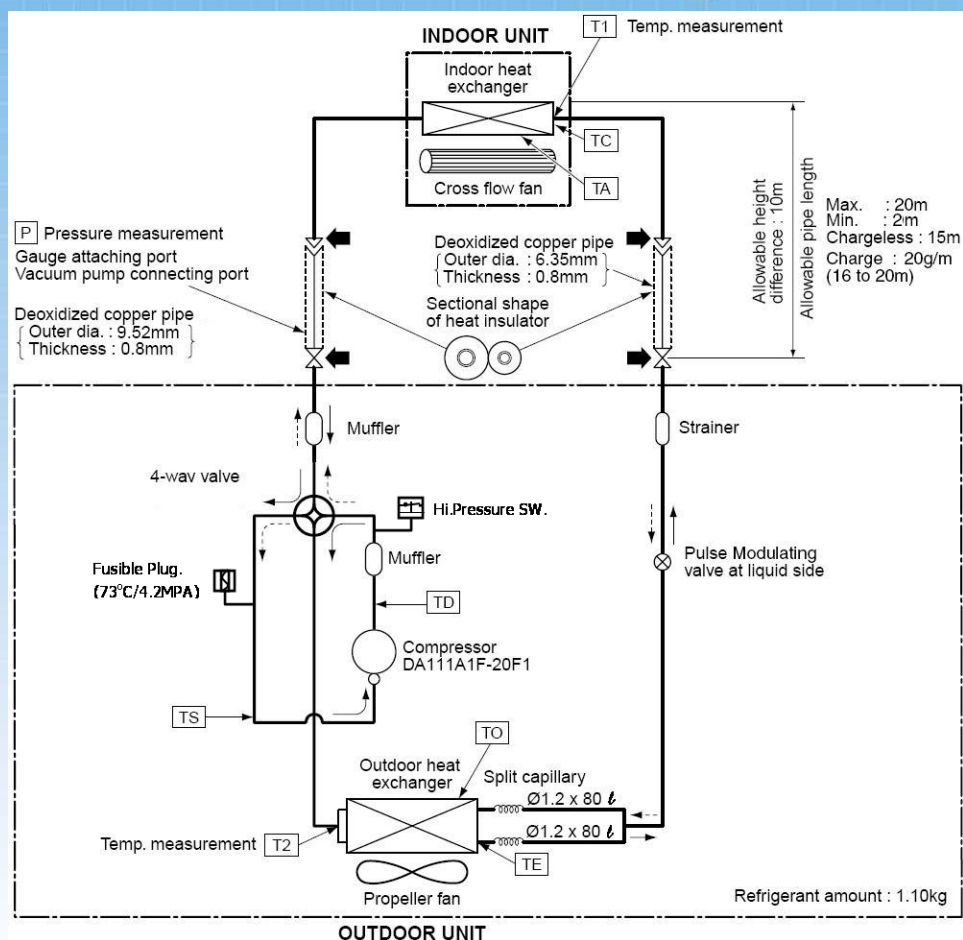
CDU :

No.	Part Name	Models	Type	Specification
1	Compressor	RAS-09LAV-UL	DA89X1C-23FZ2	3 Phases, 4P, 750W
		RAS-12LAV-UL	DA111A1F-20F1	3 Phases, 4P, 750W
		RAS-15,17LAV-UL	DA130A1F-27F	3 Phases, 4P, 1100W
		RAS-22LAV-UL	DA150A1F-20F	3 Phases, 4P, 1100W
2	Fan motor	All	ICF-340UA40-2	DC140V, 43W
3	Reator	RAS-09LAV-UL	CH69 (1 Pc.)	L=19mH, 10A
		Others	CH51 (2 Pcs.)	L=10mH, 16A
4	Coil of 4-WAY-VALVE	All	STF	AC208/230V
5	Coil PMV	All	CAM-MD12TCTH-4	DC12V
6	Pressure SW.	All	ACB-4UB82W	DC30V
7	Sensors TS, TO, TE	All	-	10k Ω (25°C)
8	Sensor TD	All	-	62k Ω (20°C)



Refrigeration Cycle Diagram

For example model RAS-12LKV-UL / RAS-12LAV-UL



Remark :

The refrigeration cycle diagram of each model is provide in the service manual.

Cooling : Coil-Valve-4Ways. = ON
Heating : Coil-Valve-4Ways = OFF

- NOTE :**
- ➡ Gas leak check position

→ Refrigerant flow (Cooling)

←--- Refrigerant flow (Heating)
 - The maximum pipe length of this air conditioner is 15 m.

When the pipe length exceeds 15m, the additional charging of refrigerant, 20g per 1m for the part of pipe exceeded 15m is required. (Max. 100g)



Refrigeration Cycle Diagram

Operation data in cooling operation.

Temperature condition(°C)		Model name RAS-	Standard pressure P Psia (MPa)	Heat exchanger pipe temp.		Indoor fan mode	Outdoor fan mode	Compressor revolution (rps)
Indoor	Outdoor			T1 °F (°C)	T2 °F (°C)			
80/67 (26.7/19.4)	98/75 (35/23.9)	09LKV-UL	137 to 160 (0.9 to 1.1)	54 to 57 (12 to 14)	99 to 102 (37 to 39)	High	High	60
		12LKV-UL	116 to 145 (0.8 to 1.0)	52 to 55 (11 to 13)	104 to 107 (42 to 44)	High	High	77

Operation data in heating operation.

Temperature condition(°C)		Model name RAS-	Standard pressure P Psia (MPa)	Heat exchanger pipe temp.		Indoor fan mode	Outdoor fan mode	Compressor revolution (rps)
Indoor	Outdoor			T1 °F (°C)	T2 °F (°C)			
70/60 (21.1/15.6)	47/43 (8.3/6.1)	09LKV-UL	363 to 392 (2.5 to 2.7)	102 to 105 (39 to 41)	32 to 37 (0 to 3)	High	High	62
		12LKV-UL	377 to 406 (2.6 to 2.8)	106 to 106 (41 to 43)	32 to 36 (0 to 2)	High	High	64

NOTES :

1. Measure surface temperature of heat exchanger pipe around center of heat exchanger path U bent.
(Thermistor thermometer)
2. Connecting piping condition 5 m

Remark : Above values are for sizes 9 and 12 K units. Service manual has the values for other sizes.



Home



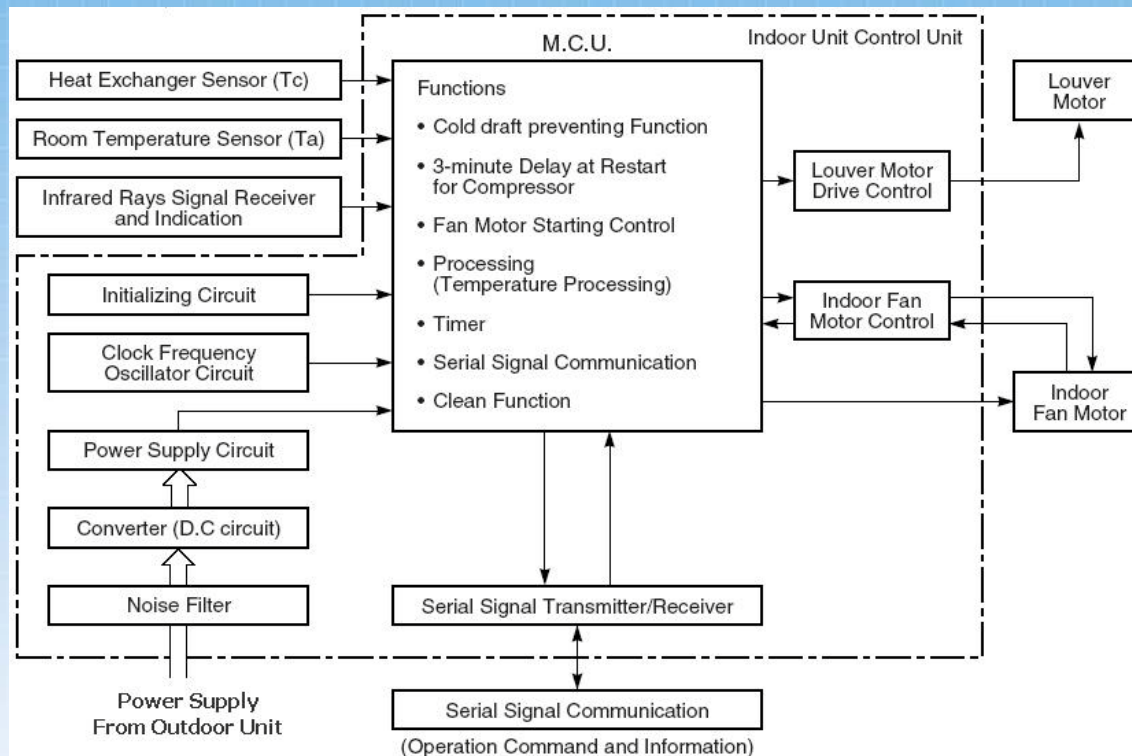
Back



Next

Control Block Diagram

FCU : For example model RAS-12LKV-UL



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



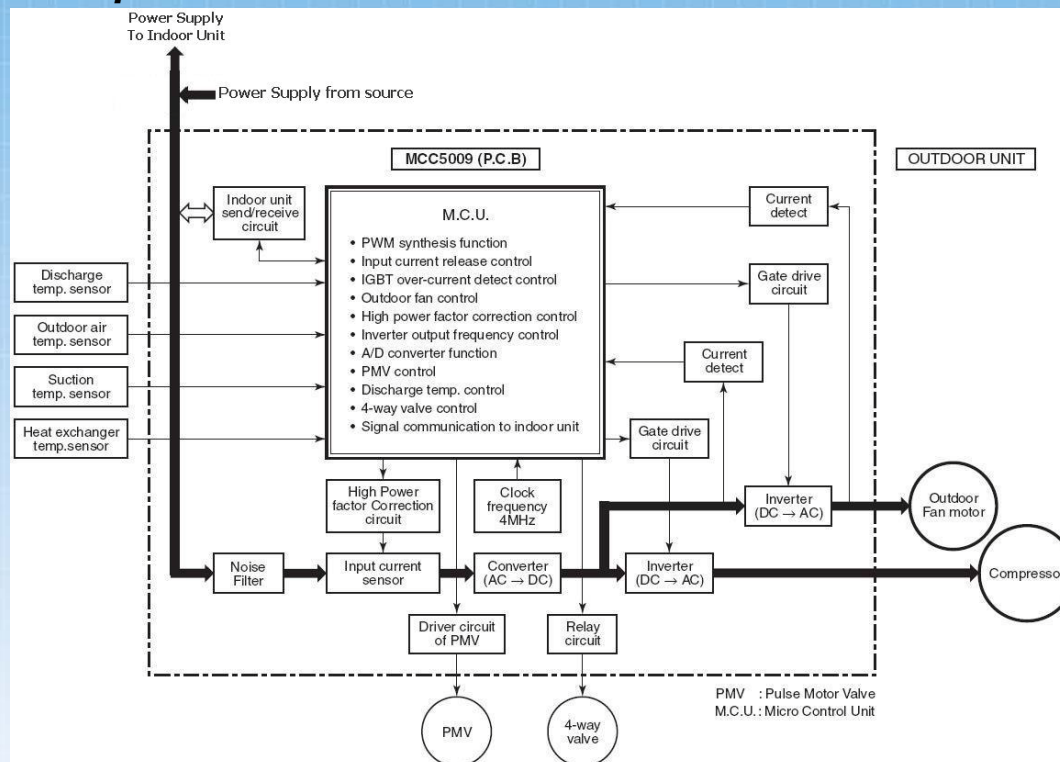
Back



Next

Control Block Diagram

CDU : For example model RAS-12LAV-UL



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back

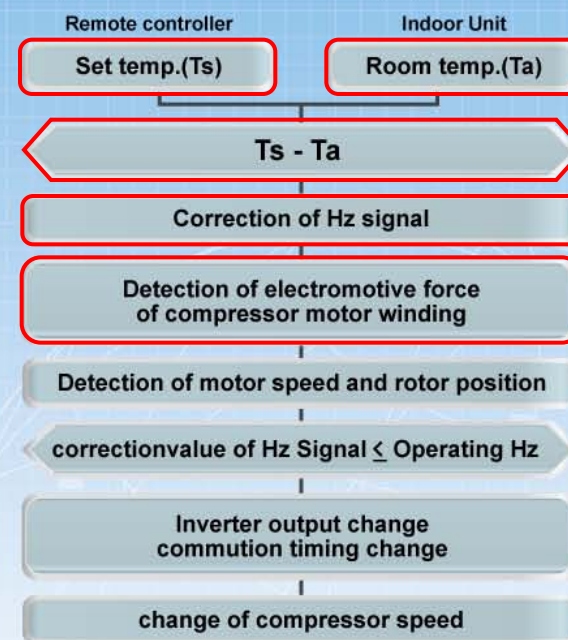


Next

Capacity Control

From the operation flow chart, it can be seen that compressor motor speed is set by calculating the difference of temperature between remote controller set temp (T_s) and room temperature detected by T_a sensor by using these following method;

1. The difference between set temperature from remote controller (T_s) and room temperature (T_a) is calculated.
2. According to the temperature difference, the correct value of is determined
3. The rotating position and speed of the motor are detected by the electromotive force occurred on the motor winding with operation of the compressor.

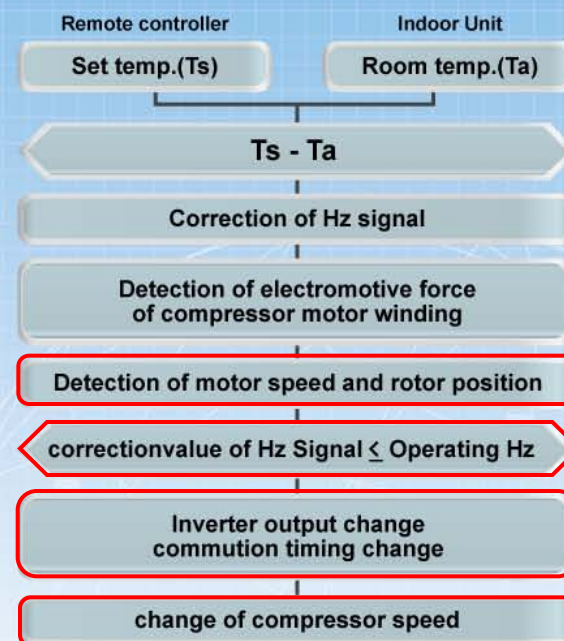


Capacity Control Continued

4. According to the difference resulted from comparison of the correction value of hertz signal with the present operation hertz, the inverter output and the commutation timing are varied.

5. Change the compressor motor speed by outputting power to the compressor.

*The content of control operation are the same for both cooling and heating operation.



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



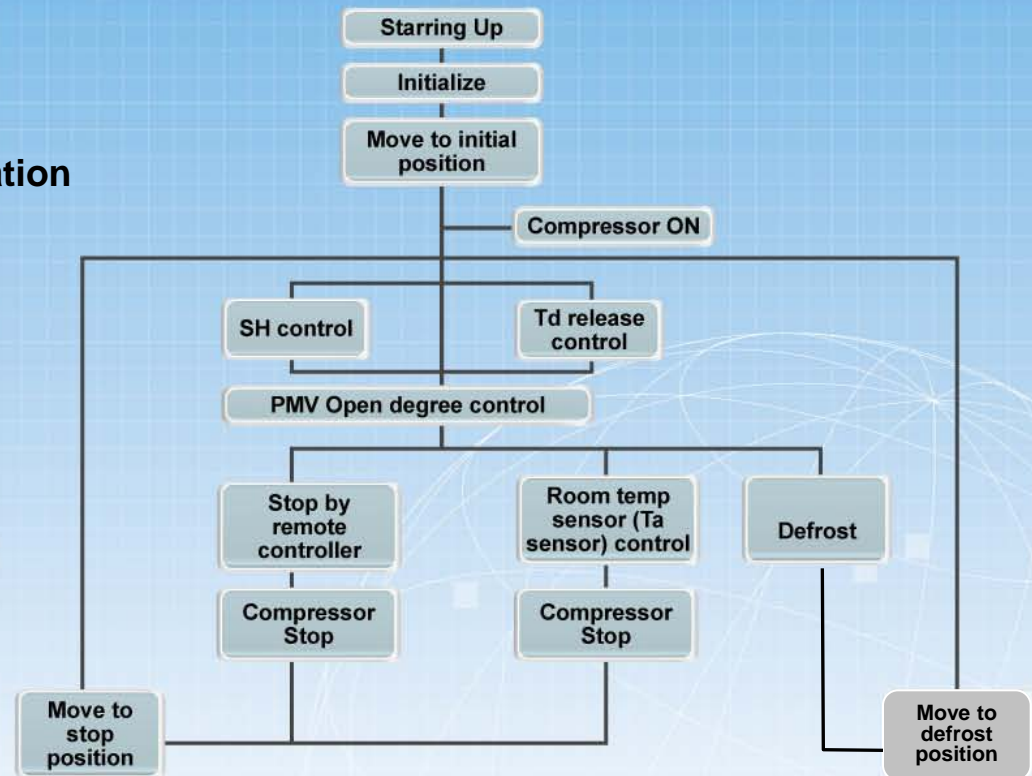
Back



Next

Pulse Modulation Value (PMV) Control

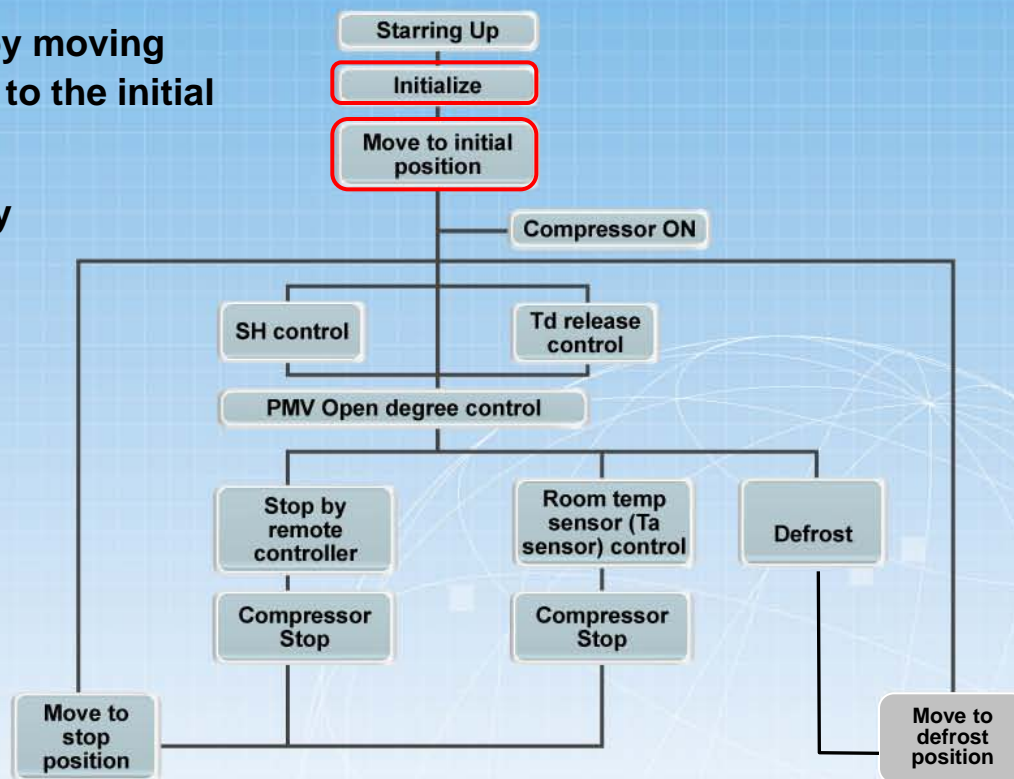
Because of the varying pressures of the system, Inverter type air conditioners use expansion valves with pulse modulation control.



Pulse Modulation Value (PMV) Control

1. At start up, the valve is initialized by moving until it hit a stopper.* It then moves to the initial position.

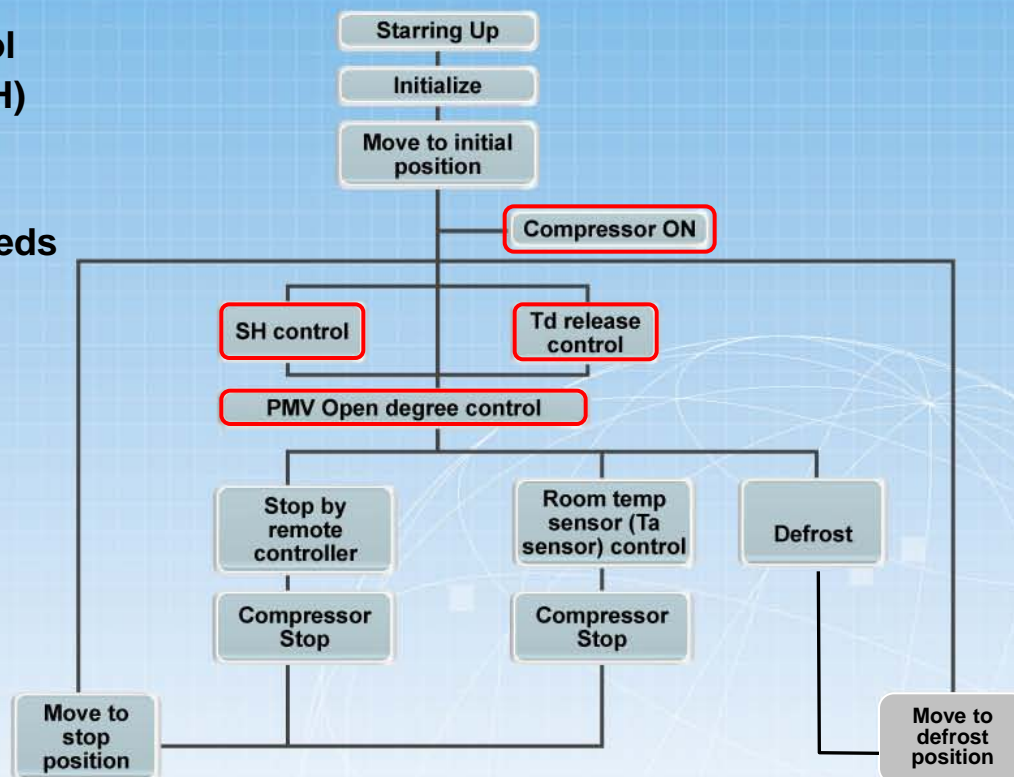
* At this time, the “click” sound may be heard.



Pulse Modulation Value (PMV) Control

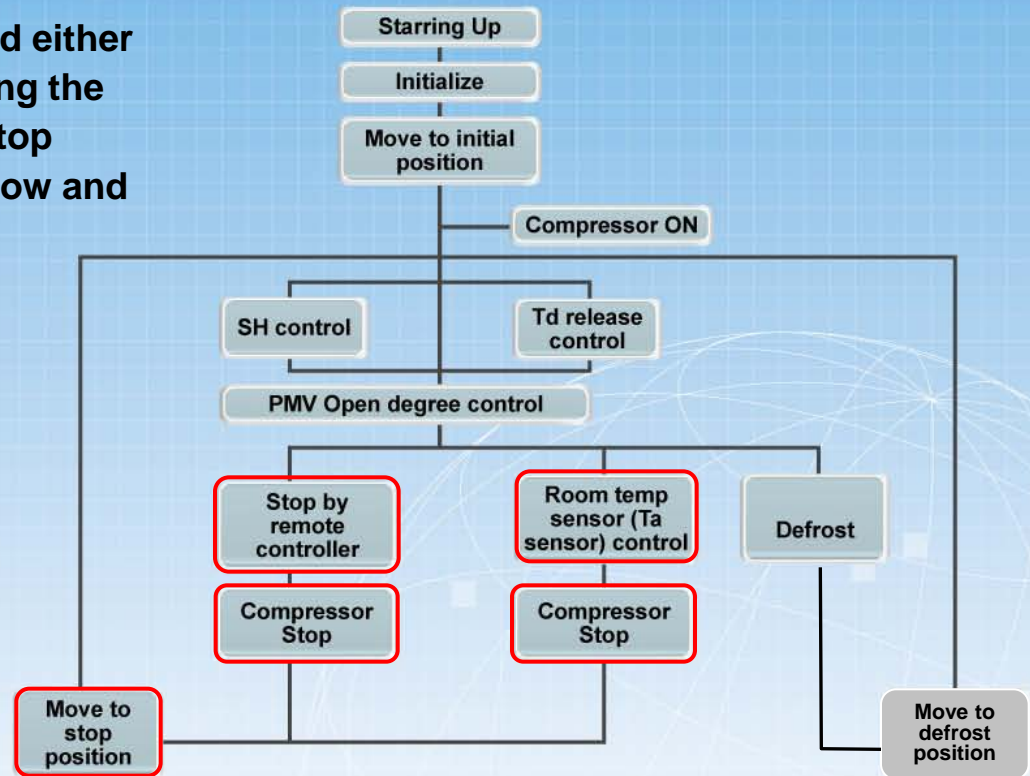
2. When the compressor is ON, control unit will measure the super heat (SH) and adjust the position of the PMV accordingly.

At the same time, the control unit needs to limit the Td result under the set value.



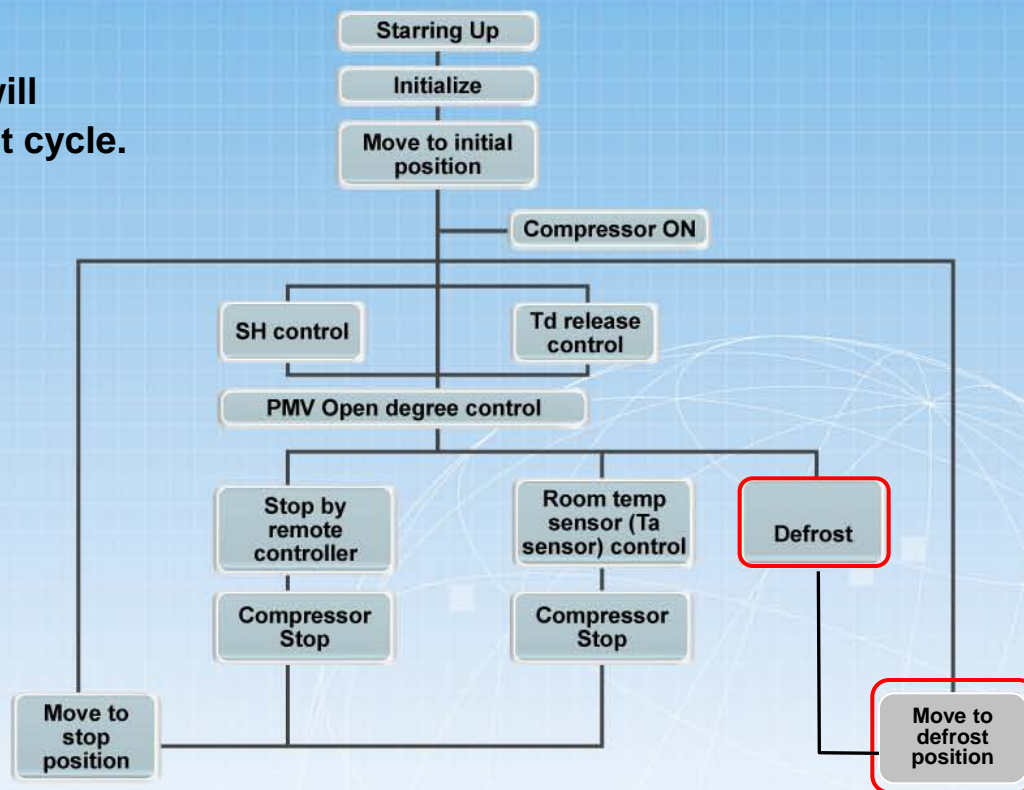
Pulse Modulation Value (PMV) Control

3. When the compressor is de energized either by the remote control or by satisfying the set point, the PMV will move to the stop position that is set to equalize the low and high pressure sides.



Pulse Modulation Value (PMV) Control

4. When defrost is initialized, the PMV will be moved to a set position that will maximize the efficiency of the defrost cycle.



Indoor Fan Control

Indoor fan can be controlled manually through the remote control or through the control board When set in AUTO using the table below.

Fan speed level	COOL	HEAT	DRY	RAS-09LKV-UL		RAS-12LKV-UL	
				Fan speed (rpm)	Air flow rate cfm (m3/h)	Fan speed (rpm)	Air flow rate cfm (m3/h)
WF		UH		1210	336 (571)	1510	433 (735)
WE		H		1210	336 (571)	1510	433 (735)
WD	UH	M+	UH	1170	321 (546)	1480	422 (717)
WC	H		H	1120	303 (515)	1430	404 (686)
WB	M+	M+	M+	1040	274 (465)	1280	350 (594)
WA			M	1000	248 (421)	1220	328 (557)
W9	M	L+		960	235 (400)	1150	302 (514)
W8		L		870	200 (340)	1000	248 (421)
W7	L+	L-	L+	850	194 (330)	980	241 (409)
W6	L		L	760	159 (270)	920	219 (372)
W5	L-	UL	L-	760	159 (270)	900	212 (360)
W4	UL		UL	700	141 (240)	840	190 (323)
W3	SUL		SUL	650	118 (200)	770	165 (280)
W2		SUL		500	65 (110)	620	110 (187)
W1				500	65 (110)	520	74 (126)

* Symbols

UH : Ultra High
 H : High
 M+ : Medium+
 M : Medium
 L+ : Low+
 L : Low
 L- : Low-
 UL : Ultra Low
 SUL : Super Ultra Low

Remark : Above values are for sizes 9 and 12 K units. Service manual has the values for other sizes.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home








Back








Next

Manual Indoor Fan Control

Cooling

Indication	Fan speed
L 	W6
L+ 	$(L + M) / 2$
M 	W9
M+ 	$(M + H) / 2$
H 	WC

Heating

Indication	Fan speed
L 	W8
L+ 	$(L + M) / 2$
M 	WA
M+ 	$(M + H) / 2$
H 	WE

In case that fan speed is set to Auto, the control board will automatically control the fan Speed.

The automatic operation will set the fan speed by considering the operation mode (Cool, Dry or Heat) and the difference between the set point and room temp. The method of controlling Auto fan speed will be explained in more detail when discussing the operation for each mode.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

Outdoor Fan Control

Outdoor fan operation is controlled by the operating mode (Cool, Dry, Heating), Outside temperature (TO) and compressor speed as shown in the “Cooling & Dry mode outdoor fan tap” table and “Heating mode outdoor fan tap” table. In case of selecting the “Eco” mode, fan speed control of outdoor unit will also be affected.

Table: Cooling & Dry mode outdoor fan tap v.s. To and compressor speed

In cooling operation							
Compressor speed (rps)		~ 13.8		~ 31.7		32.3 ~ MAX	
		MIN	MAX	MIN	MAX	MIN	MAX
To	To ≥ 100°F (38°C)	f2	f3	fC	fD	fE	fF
	To ≥ 82°F (28°C)	f2	f3	fA	fC	fD	fF
	To ≥ 59°F (15°C)	f2	f3	f7	fA	f9	fC
	To ≥ 42°F (5.5°C)	f1	f3	f2	f5	f4	f7
	To ≥ 32°F (0°C)	f1	f1	f1	f2	f2	f4
	To < 32°F (0°C)	f0	f0	f0	f1	f1	f2
During ECO mode	To ≥ 100°F (38°C)	f2	f3	fB	fC	fC	fD
	To ≥ 100°F (38°C)	f2	f3	f2	f3	fB	fC
When To is abnormal		fD	fF	fD	fF	fD	fF

Table: Heating mode outdoor fan tap v.s. To and compressor speed

In Heating operation				
Compressor speed (rps)		~16.8	~47.9	48.5 ~ MAX
To	To ≥ 50°F (10°C)	f3	f8	f9
	To ≥ 42°F (15°C)	f3	f9	fA
	To ≥ 22°F (-5°C)	f8	fA	fD
	To < 22°F (-5°C)	fB	fC	fD
During ECO mode	To ≥ 50°F (10°C)	f3	f3	f6
	To ≥ 42°F (15°C)	f3	f3	f8
	To ≥ 22°F (-5°C)	f5	f9	f9
	To < 22°F (-5°C)	f7	fA	fB
When To is abnormal		fA	fB	fD

Outdoor Fan Control

Fan speed (rpm) of each product is classified by Tap from f 0 – f F which is shown in the “Outdoor Fan Speed f 0 - f F” table

Table: Outdoor fan speed (rpm) f0 – fF by model

Tap	RAS-09LAV-UL	RAS-12LAV-UL	Tap	RAS-09LAV-UL	RAS-12LAV-UL
f 0	0	0	f 9	600	650
f 1	200	200	f A	600	700
f 2	300	300	f B	650	700
f 3	370	370	f C	700	800
f 4	440	440	f D	700	800
f 5	440	440	f E	700	800
f 6	500	500	f F	700	900
f 7	550	550			
f 8	600	600			

Note : In case that fan motor lock is detected, air conditioner will stop operate and indoor unit LED will blink

Remark : Above values are for sizes 9 and 12 K units. Service manual has the values for other sizes.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

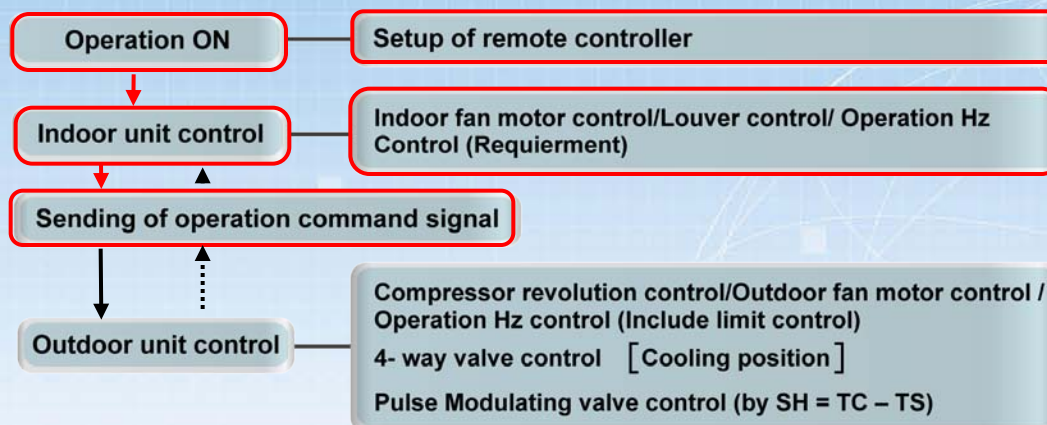
Operation Mode – Cooling Operation

Indoor unit receives signal from remote control

Indoor control unit controls indoor fan motor, louver, and calculates the compressor speed by considering room temperature and set point temperature.

The Indoor control unit will send operating commands to the Outdoor unit controller.

Operation flow chart of cooling mode operation



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



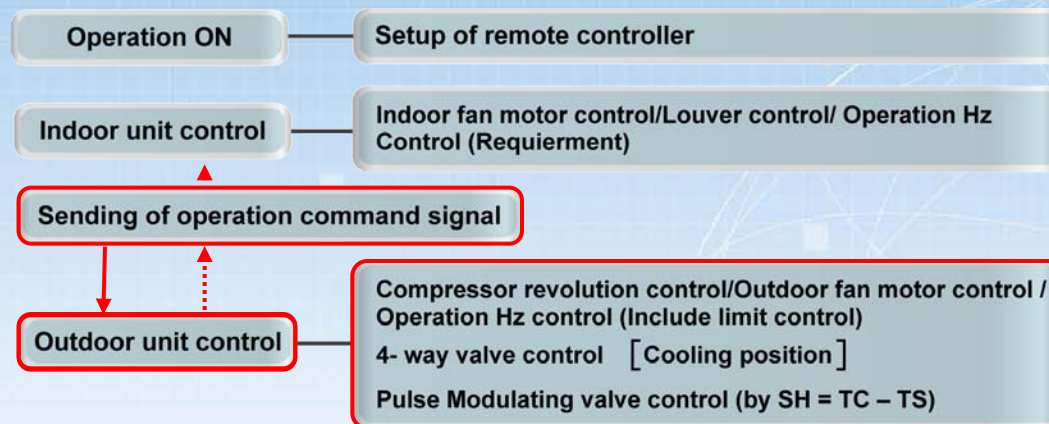
Next

Operation Mode – Cooling Operation

Outdoor unit controller controls the operation of compressor, outdoor fan motor, 4 - way valve (energized), and PMV.

The outdoor unit controller sends operation signal back to the indoor unit controller.

Operation flow chart of cooling mode operation



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back

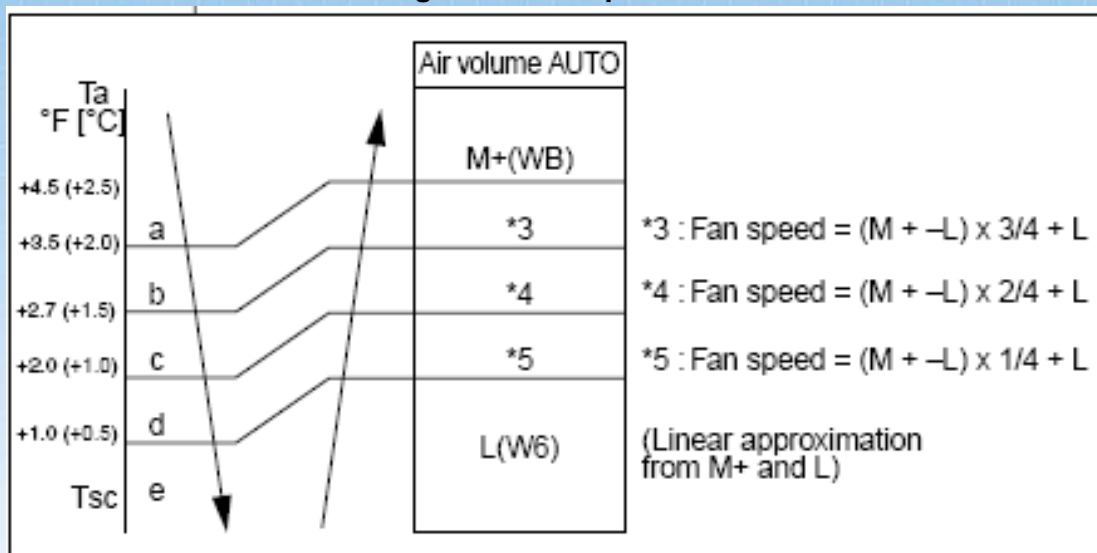


Next

Auto Fan – Cooling Operation

Auto fan speed will be controlled by the comparing the difference between the set point (T_{sc}) and the room temperature (T_a) as shown below.

Cooling Mode Fan Speed AUTO

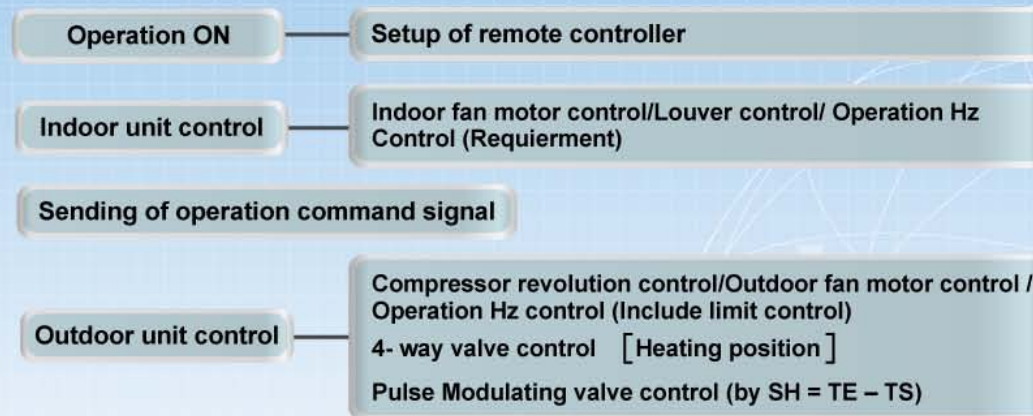


Operation Mode – Heating Operation

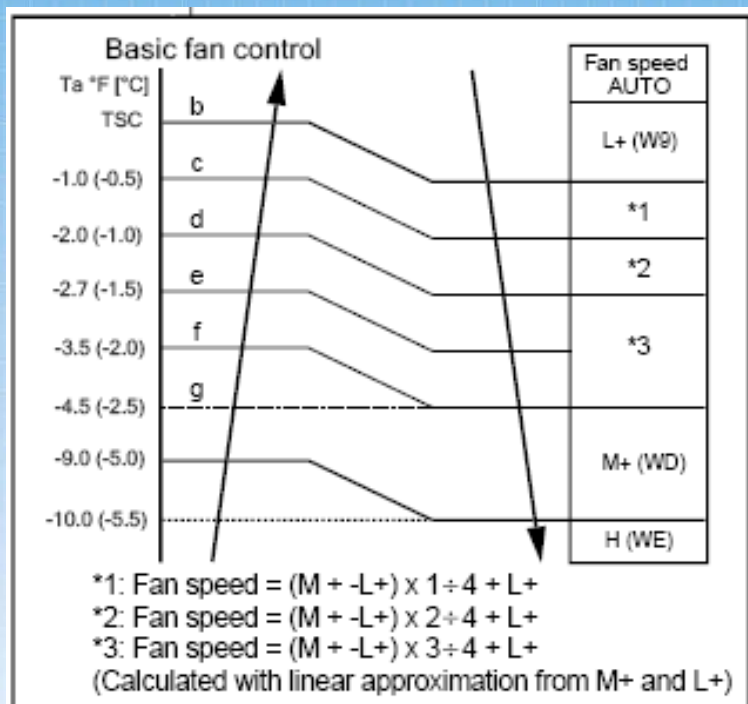
The heating mode is similar to cooling mode operation, but differs in only two items:

1. 4 way valve is de energized in heating
2. For PMV operation, Super Heat (SH) is calculated by comparing suction pipe (Ts) temperature to the outdoor heat exchanger temperature (Te).

Operation flow chart of Heating mode operation

[Introduction](#)[Installation](#)[User Training](#)[Operation](#)[Services](#)[Case Study
& FAQ](#)[Home](#)[Back](#)[Next](#)

Auto Fan – Heating Operation



Auto fan speed will be controlled by the comparing the difference between the set point (T_{sc}) and the room temperature (T_a) as shown in the graph on the left.

Note: This algorithm works as long as the TC (Indoor coil temperature) is less than 107.6 °F. If TC is ≥ 107.6 °F “Minimum Airflow Control” will take over until TC drops below 106°F.

Heating Mode fan speed AUTO

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

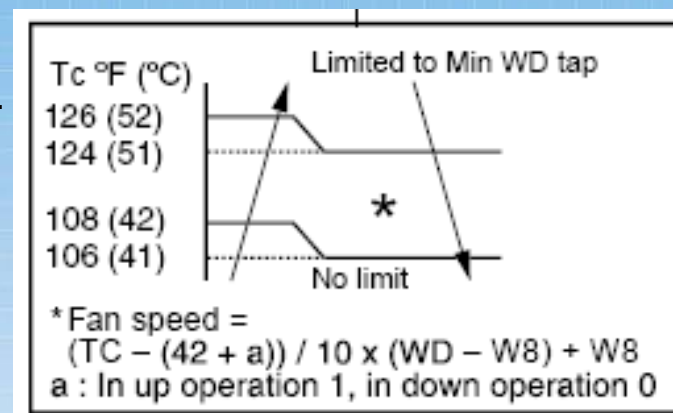
Minimum Air Flow Control

High indoor heat Exchanger temperature causes:

- High supply air temperature
- High refrigerant pressure
- Compressor overload and increased energy consumption.

To prevent above conditions, "Minimum air flow control" controls the minimum fan speed by:

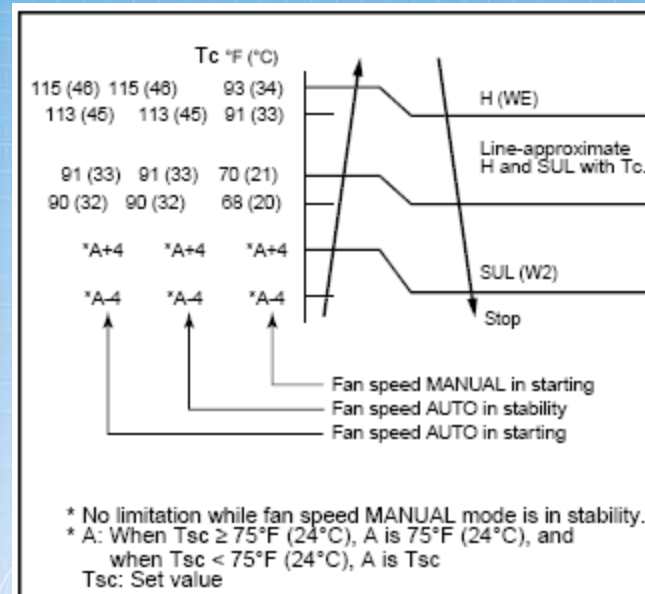
- When the temperature of Indoor Heat Exchanger raise above 108 °F, the indoor fan speed will be calculated as shown in the graph.
- If the indoor heat exchanger temperature raise above 126 °F, the indoor fan speed will be limited to WD-Tap.
- When the coil temperature drops below 124°F, the indoor indoor fan speed will be calculated as shown in the graph.
- If the indoor heat exchanger temperature drops below than 106 °F, the fan speed will be set to normal AUTO.



Minimum air flow rate control

Cold Draft Prevention

- The cold draft prevention control prevents the indoor heat exchanger temperature from getting too low by stopping the operation of the indoor fan.
- It also controls the indoor fan speed to be prevent blowing cold air from the Indoor unit.
- The cold draft prevention control will control fan speed while the compressor is operating.
- If the compressor is off, the cold draft Prevention control will also turn the indoor fan on/off and control the louver.
- This function works for both “manual” and “AUTO” fan speed.

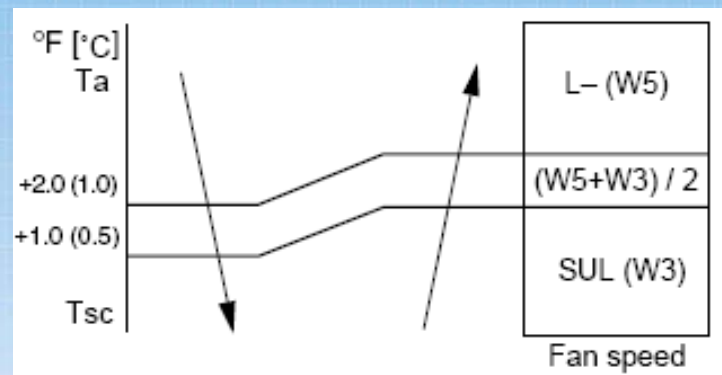


	In starting	In stability
FAN AUTO	<ul style="list-style-type: none"> • Until 12 minutes passed after operation start • When 12 to 25 minutes passed after operation start and room temp. is 5.4°F (3°C) or lower than set temp. 	<ul style="list-style-type: none"> • When 12 to 25 minutes passed after operation start and room temp. is higher than [set temp. -5.4°F (-3°C)] • When 25 minutes or more passed after operation start
FAN Manual	Room temp. < Set temp. -7°F (-4°C)	Room temp. ≥ Set temp. -6.3°F (-3.5°C)

Operation Mode - Dry Operation

- In Dry mode, the compressor speed is controlled by comparing the room temperature (T_a), and the set point temperature (T_s). Maximum hertz is limited to around 30%- 50% of the cooling operation.
- $T_{sc} = T_s + 0 \text{ to } 2^\circ\text{F}$
- When the room temperature is $\leq 2^\circ\text{F}$ than the set point, the compressor shuts off.
- Indoor unit fan control works in AUTO speed only. Fan speed control operation follow the “Dry mode fan control” Diagram.

Dry mode fan control (AUTO)



Operation Mode - Automatic Operation

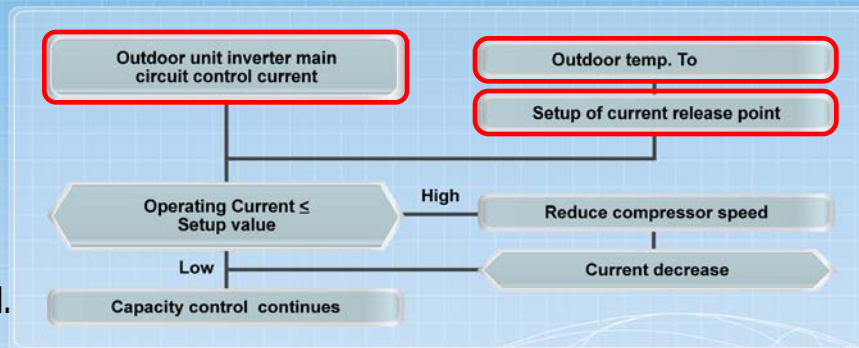
- After the indoor unit receive “Auto operation” signal from remote, the room temperature (T_a) is detected and mode is selected per the graph.
- AUTO mode can also be set by turning the system by pressing the “Reset” button on the indoor unit. The control unit will set the fan speed to “Auto” and automatically set the temperature to 75.2 °F (24°C).
- When Auto operation is started within 2 hours after a heating operation has stopped and the room temperature is 68°F (20°C) or more, the fan starts in Super Ultra Low speed for 3 minutes, after which the operating mode is selected.
- After the indoor unit controller select the operation mode to cooling, heating A/C will operate until room temperature reaches the set point then the compressor turns off. A new mode can be selected after the compressor has been de energized for at least 15 minutes.



Description of the Safety and Reliability Functions

Current Release Control

- Ensures that the electric power of the drive circuit does not exceed the allowed values.
- Input current to the outdoor unit is detected.
- Based on Outdoor temperature the allowed current is determined



Outdoor temp.	Cooling current release value		Heating current release value	
	RAS-09LAV-UL	RAS-12LAV-UL	RAS-09LAV-UL	RAS-12LAV-UL
113°F (45°C)	3.97A	4.27A	6.30A	7.72A
104°F (40°C)				
61°F (16°C)				
52°F (11°C)				
111°F (44°C)	6.30A	8.47A	6.30A	8.10A
102°F (39°C)				
60°F (15.5°C)				
51°F (10.5°C)				
			6.30A	8.47A

Table Current Release Value

Remark : Above values are for sizes 9 and 12 K units. Service manual has the values for other sizes.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back

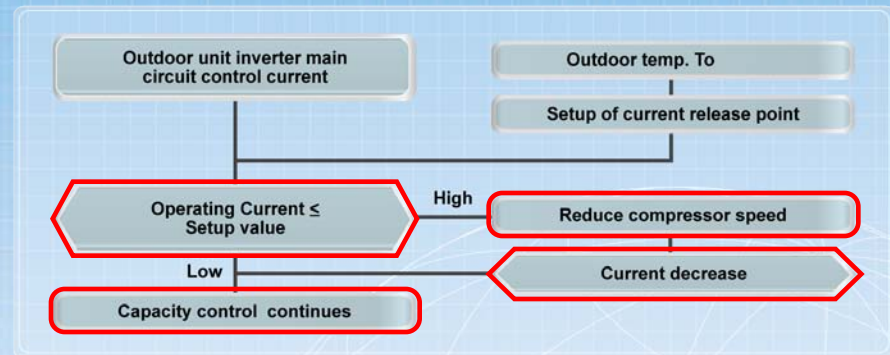


Next

Description of the Safety and Reliability Functions

➤ Current Release Control

- If the operating current set by “capacity control” is higher than the current release value, compressor speed will be managed by “current release control” instead of “capacity control”, and compressor speed will be reduced until operating current is less than current release value.
- If the operation current is less than the current release value, compressor speed will be controlled by “capacity control” as usual.



Description of the Safety and Reliability Functions

➤ Discharge temperature release control

Discharge temperature control prevents compressor temperature from getting high by monitoring the discharge pipe temperature (Td sensor). It works as follows:

1. If Td is less than 98°C, compressor operation will follow “capacity control”
2. If the discharge pipe temperature is equal to or higher than 98°C but less than 105°C, Compressor speed control will be controlled by “capacity control” but speed ramp up will be slower than usual.
3. If the discharge pipe temperature is equal to or higher than 105°C but lower than 108°C the compressor speed will be Controlled by “Discharge temperature control” and will maintain the speed.

Td value	Control operation	
243°F (117°C)	Judges as an error and stops the compressor.	6
233°F (112°C)	Reduce the compressor speed.	5
226°F (108°C)	Reduce slowly compressor speed.	4
221°F (105°C)	Keeps the compressor speed.	3
208°F (98°C)	If the operation is performed with lower speed than one commanded by the serial signal, speed is slowly raised up to the commanded speed.	2
	Operates with speed commanded by the serial signal.	1

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



Next

Description of the Safety and Reliability Functions

➤ Discharge temperature release control

4. If the discharge pipe temperature is higher than or equal to 108°C but lower than 112°C, discharge temperature control will reduce operation hertz slowly.

5. If the discharge pipe temperature is higher than or equal to 112°C but less than 117°C discharge temperature control will reduce the compressor speed.

6. If the discharge pipe temperature is more than or equal to 117°C, discharge temperature control will turn off the compressor immediately for 3 minutes

Td value	Control operation
243°F (117°C)	Judges as an error and stops the compressor.
233°F (112°C)	Reduce the compressor speed.
226°F (108°C)	Reduce slowly compressor speed.
221°F (105°C)	Keeps the compressor speed.
208°F (98°C)	If the operation is performed with lower speed than one commanded by the serial signal, speed is slowly raised up to the commanded speed.
	Operates with speed commanded by the serial signal.

After 3 minutes if the discharge pipe temperature is lower than 105°C compressor will restart again. After restarting, if Td become 117°C or more within 6 minutes, the compressor will turn off again and the unit will stop and an error code be displayed by LED blinking.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



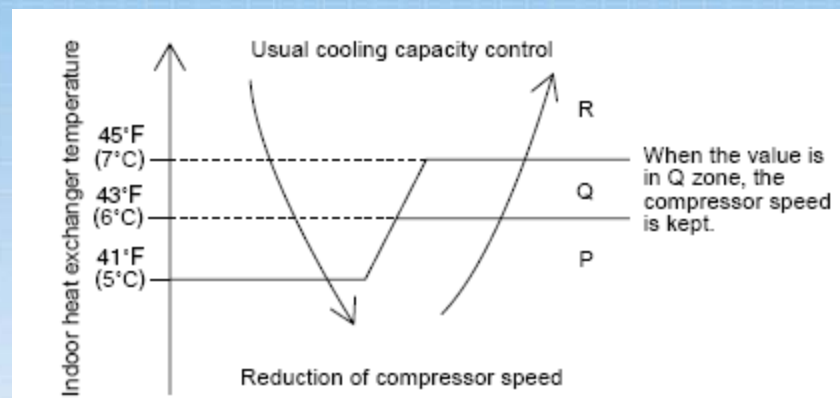
Next

Description of the Safety and Reliability Functions

➤ Indoor Heat Exchanger Temperature Control

This operation control applies for both cooling and heating modes. During the cooling operation, it provides freeze protection.

1. When the temperature of the indoor heat exchanger drops below 41°F (5°C), the Compressor speed is reduced. (P zone)
2. When the temperature of the indoor heat exchanger is between 43°F (6°C) and 45°F (7°C), the compressor speed is maintained. (Q zone)
3. When the temperature of the indoor heat exchanger rises above 45°F (7°C), the compressor speed is controlled by “capacity control” in cooling operation. (R zone)



Description of the Safety and Reliability Functions

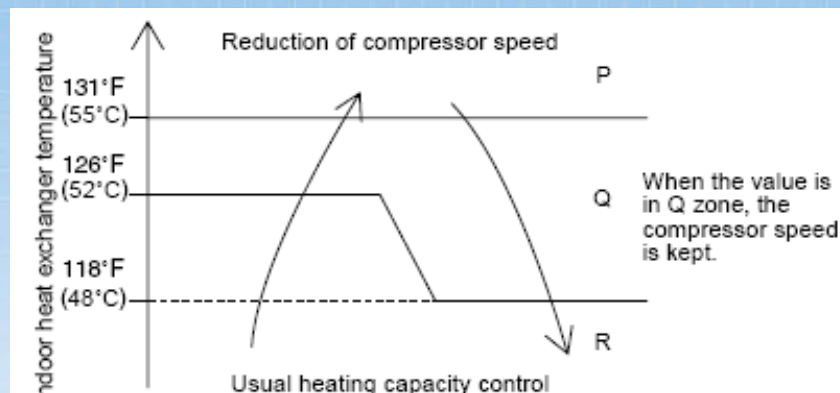
Indoor Heat Exchanger Temperature Control

During the heating operation, this function protects against high refrigerant pressures.

1. When the temperature of the indoor heat exchanger rises and operates between 126°F (52°C) and 131°F (55°C), or when the indoor heat exchanger drops and operates between 131°F (55°C) and 118°F (48°C), the compressor speed is maintained. (Q zone)

2. When the temperature of the indoor heat exchanger rises to 131°F (55°C) or higher, the compressor speed is reduced. (P zone)

3. When temperature of the indoor heat exchanger rises but does not exceed 126°F (52°C), or when it drops below 118°F (48°C), the “capacity control” controls the compressor speed. (R zone)



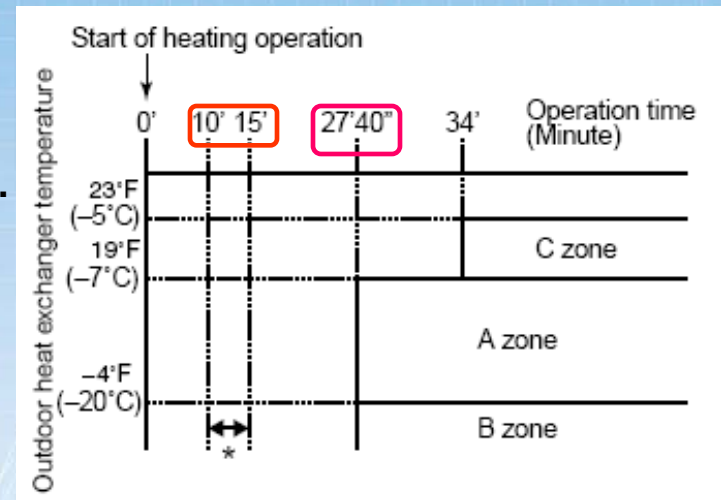
Description Control (Only in heating operation)

How defrosting operation starts?

The temperature sensor of the outdoor heat exchanger determines when the defrost cycle is Initiated.

10 to 15 minutes after the heating operation starts, the lowest value of the TE sensor is stored in memory as Te0.

When the heating mode operates for 27 minutes 40 seconds, the outdoor unit controller starts comparing Te0 with the TE result.



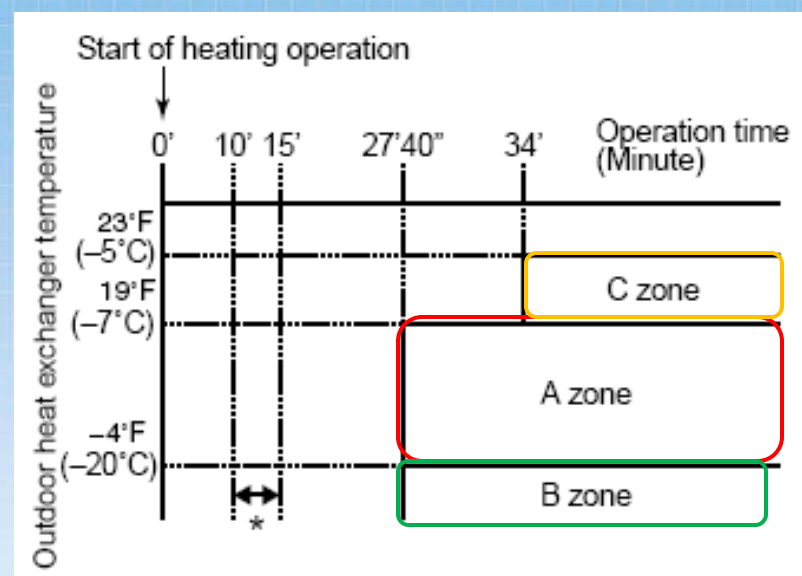
Description Control (Only in heating operation)

➤ How defrosting operation starts?

If TE is in zone A and $T_{e0} - TE \geq 4.5^{\circ}\text{F}$ (2.5°C) continues for 2 minutes, the outdoor unit Controller will start the defrost operation.

If TE is zone B for 2 minutes, the outdoor unit controller will start defrost operation without comparison with T_{e0} .

If TE is in zone C and $T_{e0} - T_e \geq 3^{\circ}\text{C}$ for 2 minutes, the outdoor unit controller will start the defrost operation.



Description Control (Only in heating operation)

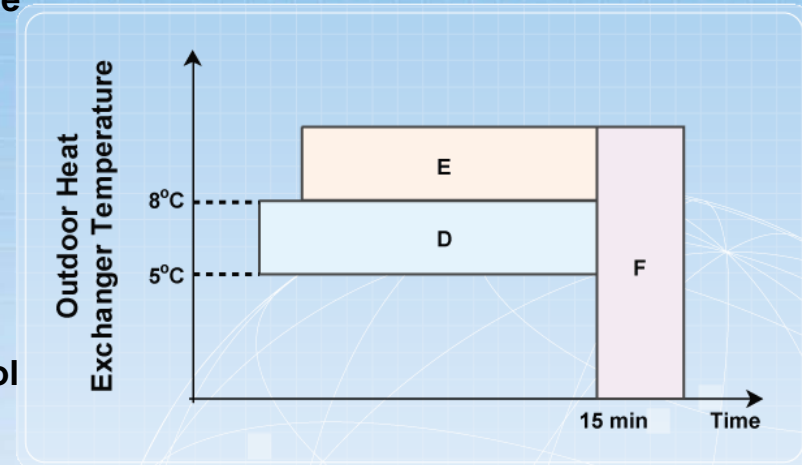
➤ How defrosting operation stop?

The Outdoor unit controller measures the temperature of the outdoor heat exchanger and terminates the defrost operation when:

The outdoor heat exchanger temperature (TE) is $\geq 41^{\circ}\text{F}$ (5°C) but $< 46^{\circ}\text{F}$ (8°C) for 80 second. (Case-D)

TE is $\geq 46^{\circ}\text{F}$ (8°C) (Case - E)

The defrost operation lasted for 15 minute. The control unit will stop the defrost operation and restart the heating operation automatically. (Case F)



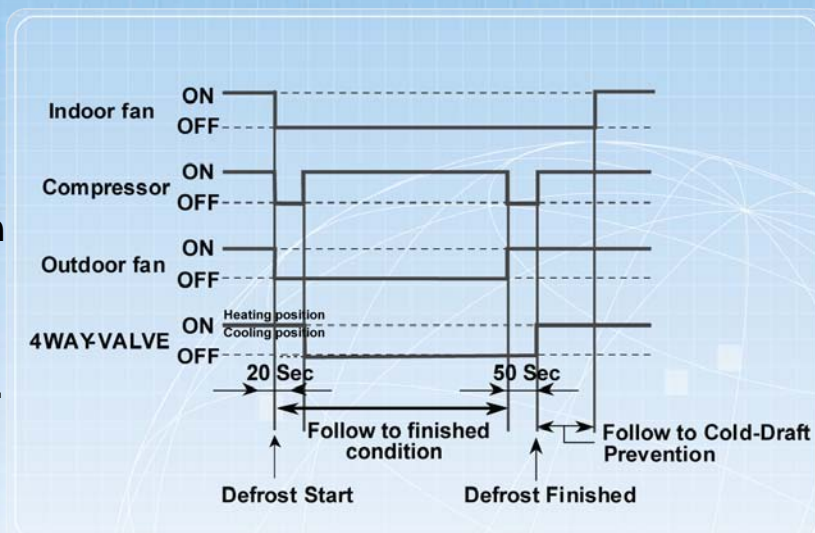
Description Control (Only in heating operation)

Operation of the component parts

When the outdoor unit controller starts defrosting compress or and outdoor fan will stop for 20 seconds to prepare the reverse cycle. 10 second after the compressor is de-energized, the 4-way valve changes from heating position to cooling position, and Indoor fan is controlled by “cold draft prevention control”.

After the compressor restarts, the heat from the outdoor heat exchanger is used to melt the frost. The indoor fan will be off.

Parts Operation Diagram of the defrosting operation



Description Control (Only in heating operation)

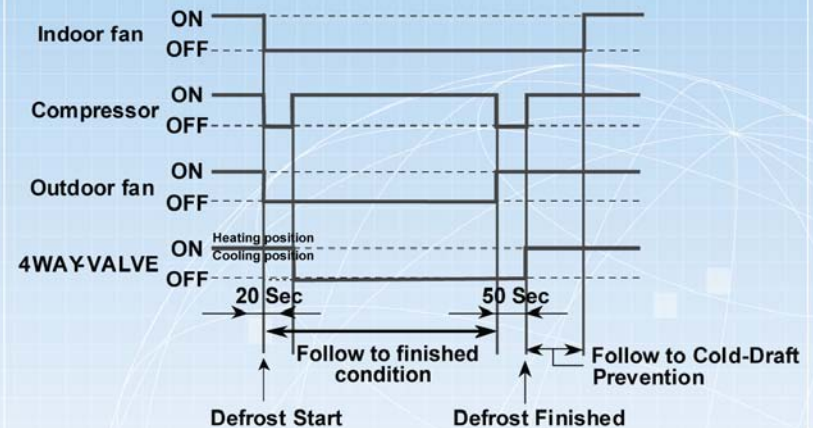
Operation of the component parts

After defrost terminates, the compressor is de-energized 50 seconds. The 4-way valve is de-energized 40 seconds after the compressor is de-energized.

After 50 seconds, the compressor and outdoor fan are energized at the same time.

Indoor fan will operate under the “Cold draft prevention Control” algorithm.

Parts Operation Diagram of the defrosting operation



Operation Description of Product Features

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home

Certified Installer Program CIP



Back



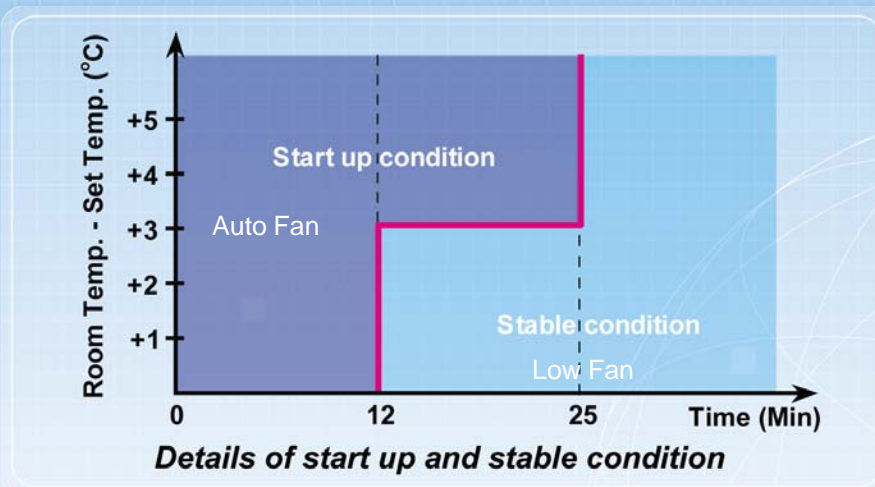
Next

Operation Description for 'One Touch Comfort'

One touch comfort starts up the system with conditions already preset from the factory.

The system operates in two zones that are a function of the elapsed time and the difference between the room temperature (T_a) and the set point (T_s) as shown in graph below.

Any signal received from remote control will cancel the comfort mode.



Conditions Set At Factory

- Auto mode
- Set temperature of 75°F (24°C)
- Default louver position of mode
- Fan speed Auto or Low

Operation Description for 'Hi Power'

Hi Power mode can be selected if unit is running in Auto, Cool, or Heat modes only.
The following takes place:

Auto mode

No change in operation

Cooling operation mode

Setting Temperature : Set point is reduced by 2°F (1°C) – value does not change on remote
Fan Speed: Increased by one tap

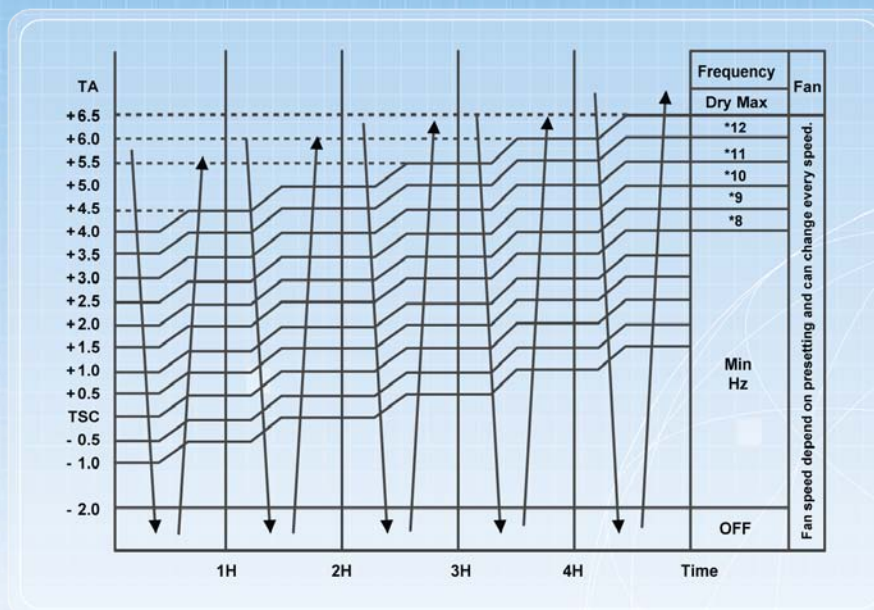
Heating operation mode

Setting Temperature : Set point is increased by 3.5°F (2°C) – value does not change on remote
Fan Speed: Increased by one tap

[Introduction](#)[Installation](#)[User Training](#)[Operation](#)[Services](#)[Case Study
& FAQ](#)[Home](#)**Certified Installer Program (CIP)**[Back](#)[Next](#)

Operation Description for 'ECO' Operation - Inverter

Set point is adjusted by 0.9°F (0.5°C) per hour for a total of 3.6°F (2°C) in 4 hours.



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

Operation Description for 'ECO' Operation - Inverter

'ECO' function for Inverter model also limit the operation Hz. of compressor for more energy saving.

Hz	09LAV	12LAV	15LAV
Cool min	20	13	13
DRY max	35	31	35

Operation Hz of compressor will also set by the difference of Ta-TSC as shown on previous page.
 Operation Hz of compressor will be calculated by the following formula .

- * $12 (\text{DRY max} - \text{COOL min}) / 6 \times 5 + \text{COOL min}$
- * $11 (\text{DRY max} - \text{COOL min}) / 6 \times 4 + \text{COOL min}$
- * $10 (\text{DRY max} - \text{COOL min}) / 6 \times 3 + \text{COOL min}$
- * $9 (\text{DRY max} - \text{COOL min}) / 6 \times 2 + \text{COOL min}$
- * $8 (\text{DRY max} - \text{COOL min}) / 6 \times 1 + \text{COOL min}$

Remarks : ECO is not suitable in the condition of high cooling load because cooling capacity may not be sufficient

Remark : Control values are for example only. Please confirm service manual model by model.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home

Certified Installer Program (CIP)



Back

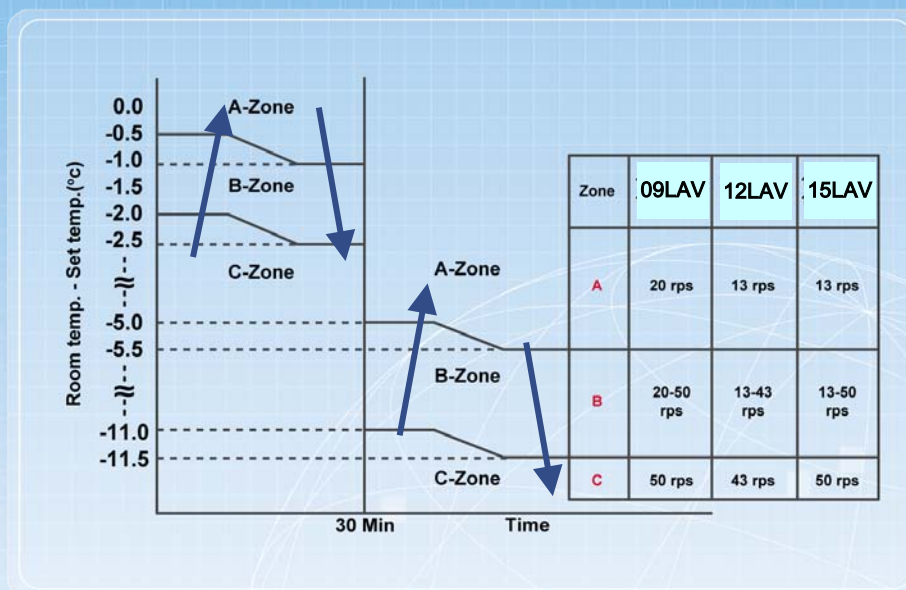


Next

Operation Description for 'ECO' Operation - Inverter

Heating operation

ECO operation for heating mode will start immediately when the ECO button on a remote control has been pressed. The operation hertz of compressor will be limited to 3 ranges A, B, C .
 Operation hertz of each model is set differently, for example.



Remark : Control values are for example only. Please confirm service manual model by model.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home

Certified Installer Program (CIP)



Back

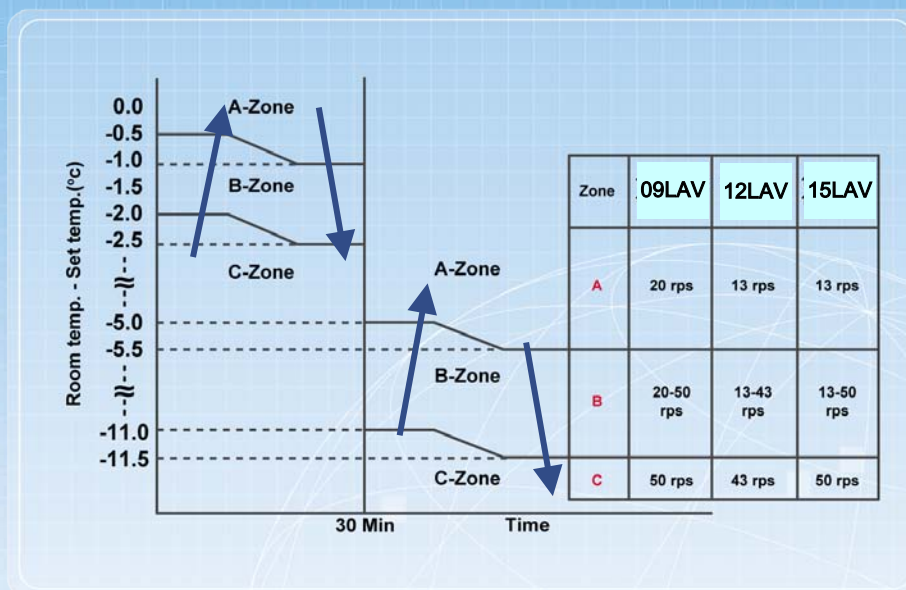


Next

Operation Description for 'ECO' Operation - Inverter

Heating operation

When the ECO operation starts operation hertz of compressor will be controlled by using the difference between room temperature and set temperature. The operation hertz of these A,B,C zones are lower than frequencies set by capacity control.



Remark : Control values are for example only. Please confirm service manual model by model.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home

Certified Installer Program (CIP)



Back



Next

Operation Description for 'Comfort Sleep' Operation

COMFORT SLEEP :

= ECO + SLEEP TIMER + AUTO FAN

Remarks :The COMFORT SLEEP operation can not be set in Dry mode or Fan-Only mode.

Benefits of comfort sleep function are:

- Quietness for more comfort, when the room temperature reaches the set temperature.
- Save energy by changing the room temperature automatically
- The air conditioner can shut down automatically

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

Operation Description for 'Quiet' Operation

When Quiet operation is pushed, the fan speed is restricted to running at L- until the Quiet button is pushed again.

Because of the limited air flow, the cooling or heating capacity might not be sufficient to meet the load.

Quiet operation cannot be set when unit is running in the Dry mode.

[Introduction](#)[Installation](#)[User Training](#)[Operation](#)[Services](#)[Case Study
& FAQ](#)[Home](#)[Back](#)[Next](#)

Operation Description for the 'Self-Cleaning' Operation

The 'self-cleaning' function is designed to reduce humidity that could cause the growth of mold inside the unit. This is accomplished by energizing the indoor fan for a period of 30 minutes after the unit is shut off. If desired, this function can be stopped by the user or disabled as shown on the next slide.

Operation display	ON	OFF	OFF
FCU fan	ON rpm is depend on presetting.	500 rpm	OFF
FCU louver	OPEN	CLOSE	CLOSE
Timer display Normal	ON Slidhtly pen depend on presetting of timer function	ON	ON or OFF depend on presetting of timer function
Compressr	ON or OFF depend on presetting per room temperature	OFF	OFF
CDU fan	ON or OFF depend on presetting per room temperature	OFF	OFF

Operating time

[Introduction](#)
[Installation](#)
[User Training](#)
[Operation](#)
[Services](#)
[Case Study
& FAQ](#)

[Home](#)

[Back](#)

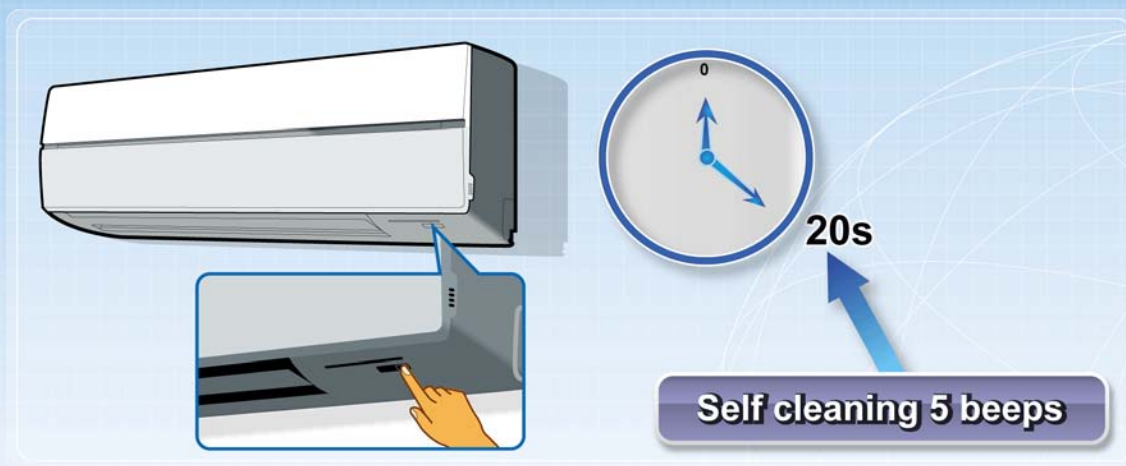
[Next](#)

Operation Description for the 'Self-Cleaning' Operation

To set reset

When the 'Self-Cleaning' function is set, after 20 seconds there will be a beeping sound from the control unit 5 times and the operation lamp will blink. If it has been reset, after 20 seconds, there will be a beeping sound, but the operation lamp will not blink.

The 'self-cleaning' function is set as default from the factory, it can be stopped manually by pressing the on/off button on the remote control twice



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

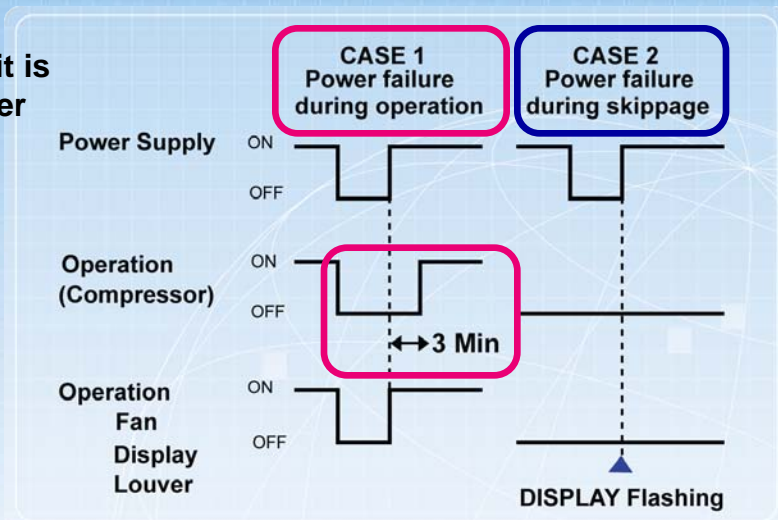
Operation Description for the 'Auto-restart' Operation

The indoor unit is equipped with an automatic restart function which allows the unit to restart with the set operating conditions in of a power failure. The operation will resume three minutes after the power is restored.

There are two scenarios for the Auto-restart operation.

Scenario 1 is when the power failure occurs while the unit is operational, the AC will restart automatically 3 minutes after power is restored.

Scenario 2, if the power failure occurs while the unit is off, the unit will not run after the power is restored. The Operation lamp will flash.



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home

Certified Installer Program CIP

Back

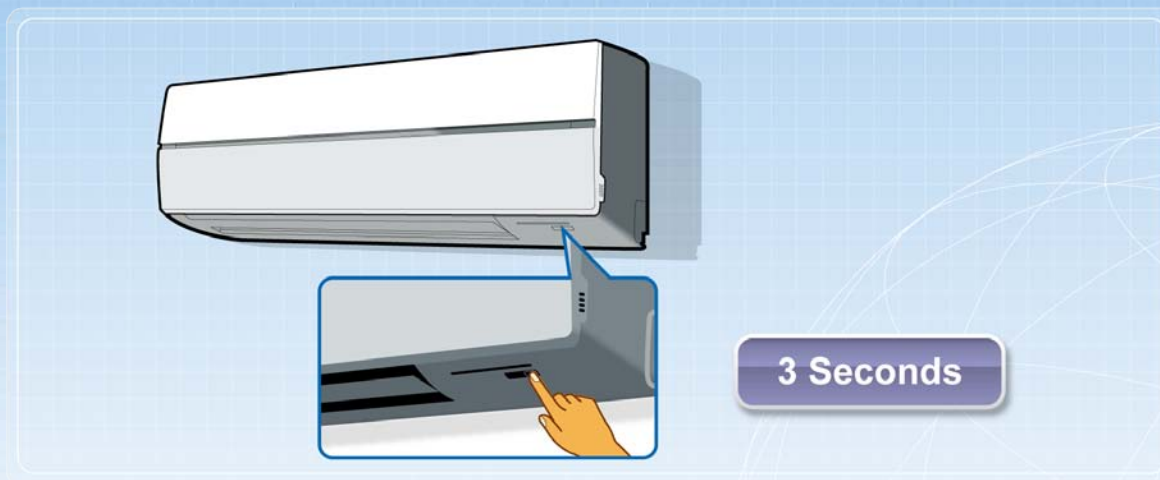


Next

Operation Description for the 'Auto-restart' Operation

To disable the 'auto-restart' function, press and hold the reset button on the indoor unit for 3 seconds. What happens next depends if the unit is in standby or operating mode.

If unit is in standby mode, the green operation light is on, the unit starts to operate, and 3 beeps are heard. If the unit has been running, the green operation light is off, the unit is off, and 3 beeps are heard.



Remarks : Timer ON/OFF is cancelled if there is a power failure.

[Introduction](#)[Installation](#)[User Training](#)[Operation](#)[Services](#)[Case Study
& FAQ](#)[Home](#)[Back](#)[Next](#)

Services



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

How to diagnose the problem

Troubleshooting Procedure

- 1. Confirm if symptoms are normal or not**
- 2. Primary Diagnosis**
 - 2.1 Check flashing LED's of Indoor unit**
 - 2.2 Self – Diagnosis using the error code on the remote control**
 - 2.3 Diagnosis using the system symptoms**
- 3. How to Check the Main Parts**

[Introduction](#)[Installation](#)[User Training](#)[Operation](#)[Services](#)[Case Study
& FAQ](#)[Home](#)[Back](#)[Next](#)

How to diagnose the problem

1. Confirm is symptoms are normal

1.1 Confirm that the power breaker operates (ON) normally.

1.2 Confirm that the voltage supplied is in the range of $\pm 10\%$ of the rated voltage.

If power voltage is not in this range, the unit may not operate properly.

1.3 Normal operation

These are the normal condition for the Toshiba Carrier units.

1. When the main power supply is turned on, the OPERATION lamp on the indoor unit blinks.

2. The compressor does not energize even if there is a call for heating and cooling. (3 minute time delay)

3. In Dry Operation, Fan (air flow) display on the remote control does not change even though Fan (air flow) button is selected.

4. Increasing of compressor motor speed stops approx 30 sec after operation started, then compressor motor speed increases again approx 30 sec later

5. In AUTO mode, the operation mode is changed.



Home



Back



Next

How to diagnose a problem

2. Primary Diagnosis

To diagnose a problem, use the following methods.

2.1 Check the flashing LED's of indoor unit.

2.2 Self – diagnosis using the error code on the remote control

2.3 Diagnosis using the system symptoms

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

Failure diagnosis

2.1 Judgment by flashing LED of the indoor unit

To diagnose the troubles, use the following methods.

The indoor unit is equipped with a self-diagnosis function that indicates when a problem occurs by flashing the LED lights on the display panel. Installers and service mechanics need to check the details of each model in the service manual before starting any service work.

The following can be displayed on the front panel of the indoor unit:

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

Diagnosis using flashing LED of the indoor unit

The operation light (green) flashes 1 time per second. This indicates that there was a power failure or the power supply is turned on.



Case A.

Self-diagnosis

Power failure (when the power supply is turning on)

*1Hz = 1 time in 1 sec.

[Introduction](#)[Installation](#)[User Training](#)[Operation](#)[Services](#)[Case Study
& FAQ](#)[Home](#)[Back](#)[Next](#)

Diagnosis using flashing LED of the indoor unit

When the operation light flashes 5 times per second, it can be assumed that there are some problems occurring in one or all of these areas:

**Case B.****Self-diagnosis**

Protective circuit operation for indoor P.C. board

***5Hz = 5 times in 1 sec.**

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

Diagnosis using flashing LED of the indoor unit



Case C.	Lamps	Self-diagnosis
	OPERATION and TIMER lamps are blinking.(5Hz)	Wrong wiring of connecting cable

*5Hz = 5 times in 1 sec.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

Diagnosis using flashing LED of the indoor unit



Case D.

Lamps

OPERATION and FILTER lamps are blinking.(5Hz)

Self-diagnosis

Protective circuit operation for outdoor P.C. board

*5Hz = 5 times in 1 sec.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next



Case E.	Lamps	Self-diagnosis
	OPERATION, TIMER and FILTER lamps are blinking.	Protective circuit operation for others (including compressor)

*5Hz = 5 times in 1 sec.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

Failure diagnosis

2.2 Self-diagnosis by remote controller (Check code)

The remote control can also be used as a diagnostic tool. When set to the service mode, the remote control will provide check codes that will enhance the diagnostic process.

If a fault is detected, all lamps on the indoor unit will flash at 5Hz and the unit will beep for 10 seconds (Beep, Beep, Beep.....) The timer lamp usually Flashes (5Hz) during self-diagnosis.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

Self-diagnosis by remote controller

How to set Remote Control to service mode Clear memory code

➤ Clear the code in the microcontroller memory by:

1. Press [CHK] button with the tip of a pencil to set the remote control to the service mode.
 - “00” is indicated on the display of the remote control.
 - The timer lamp on the indoor unit blinks continuously. (5 Hz)



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

Self-diagnosis by remote controller

How to set Remote Control to service mode



2. Press [CLR] button to ensure that previous errors are cleared.

➤ “7F” is indicated on the display of the remote control.

Caution : Error code needs to be clear prior to performing diagnosis error code by using the remote control. Otherwise the error code may be incorrect.

3. Start operation again and wait until operation blinks 1 Hz

4. Start the Self-diagnosis by using the remote control.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

Self-diagnosis by remote controller

Start the Self-Diagnosis



1. Press [CHK] button with the tip of a pencil to set the remote control to the service mode.

- 00 is indicated on the display of the remote control.
- The timer lamp on the indoor unit blinks continuously. (5 Hz)

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

Self-Diagnosis by using the remote control



2. Press ▲ or ▼ button in the timer area to change the code forward or backward. If there is no fault the indoor unit will beep once (pi) and the display of the remote control will change as follows

00 01 02 1d 1E 33

- The TIMER indicator of the indoor unit flashes continuously. (5 times per second)
- Check the unit with all 52 check codes (00 to 33) as shown in the next table.
- Press ▲ or ▼ button to change the check code forwards or backwards.

If there is a fault, the indoor unit will beep for 10 seconds (Pi Pi Pi) Note the check code on the display of the remote control.

- 2 alphanumeric digits will be indicated on the display.
- All lamps on the indoor unit will blink.(5Hz)

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

Self-Diagnosis by remote control - Error code

Block distinction		Operation of diagnosis function				Judgment and action
Check code	Block	Check code	Cause of operation	Air conditioner status	Remarks	
00	Indoor P.C. board etc.	0C	Short-circuit or disconnection of the room temperature sensor (TA sensor)	Operation continues.	Displayed when error is detected.	1. Check the room temp.sensor 2. When the room temp.sensor is normal,check P.C. board.
		0d	Being out of place, disconnection,short-circuit,or migration of heat exchanger sensor (TC sensor)	Operation continues.	Displayed when error is detected.	1. Check heat exchanger sensor. 2. When heat exchanger sensor is normal,check P.C. board.

For example, if the screen shows 0C and the indoor unit beeps for 10 seconds, The installer needs to refer to the table in the service manual which will indicate that the cause of the problem for 0C is from a short-circuit or disconnection of the room temperature sensor (TA). The way to diagnose this problem is to check the room temp sensor. If the room temp sensor is normal then check the PC board.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



Next

Self-Diagnosis by remote control - Error code

Or taking another example, when the check code turns to 11 on the remote control screen, then the indoor unit will beep for 10 seconds. It is because of an indoor fan lock or trouble on the indoor fan circuit. The service mechanic should check the PC board first. If the PC board is normal then check the motor.

Block distinction		Operation of diagnosis function				Judgment and action
Check code	Block	Check code	Cause of operation	Air condition status	Remarks	
		11	Look of indoor fan or trouble on the indoor fan circuit	All off	Displayed when error is detected.	1. Check P.C. board. 2. When P.C. board is normal, check the motor.
	Not displayed	12	Trouble on other indoor P.C. boards.	Operation continues	Displayed when error is detected.	Replace P.C. board.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



Next

Self-Diagnosis by remote control - Error code

Block distinction		Operation of diagnosis function				Judgment and action
Check code	Block	Check code	Cause of operation	Air conditioner status	Remarks	
01	Connecting Cable and serial signal	04	<p>Return serial signal is not sent to indoor side when the operation started.</p> <p>1) Defective wiring of connecting cable</p> <p>2) Operation of compressor thermo Gas shortage Gas leak</p>	Operation continues.	Flashes when trouble is detected on return serial signal and normal Status when signal is reset.	<p>1. When the outdoor unit never Operate:</p> <p>1) Check connecting cable, correct if detective wiring</p> <p>2) Check 25A fuse of inverter P.C. board</p> <p>2. To display (Other) block during operation, check compressor thermo. Operation and supply gas (also check gas leak)</p> <p>3. Unit operates normally during check. If return serial signal does not stop between indoor terminal board 2 and 3, replace inverter P.C. board. If signal stops between indoor terminal board 2 and 3, replace indoor P.C. board.</p>

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



Next

Self-Diagnosis by remote control - Error code

Block distinction		Operation of diagnosis function				Judgment and action
Check code	Block	Check code	Cause of operation	Air conditioner status	Remarks	
02	Outdoor P.C. board	14	Inverter over-current protective circuit (short time)	All off	Displayed when Error is detected.	Remove connecting lead wire of compressor and try to operate again. If still error : Replace P.C.Board. But if operation of outdoor fan is normal : Replace compressor.
		16	Position-detect circuit Error or short-circuit Between winding of compressor	All off	Displayed when Error is detected.	1. Remove connecting lead wire of Compressor, if position-detect circuit still error: Replace P.C. board 2. Measure resistance between wires Of compressor and perform short-circuit: Replace compressor
		17	Current-detected circuit error	All off	Displayed when Error is detected.	Even when trying to operate again, all operations stop immediately: Replace P.C. board
		18	Disconnection or short-circuit of the outdoor heat exchanger sensor (TE) or suction temp sensor (Ts)	All off	Displayed when Error is detected.	1. Check sensor (TE, Ts) 2. Check P.C. board

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



Next

Self-Diagnosis by remote control - Error code

Block distinction		Operation of diagnosis function				Judgment and action
Check code	Block	Check code	Cause of operation	Air conditioner status	Remarks	
02	Outdoor P.C. board	19	Disconnection or short-Circuit of discharge temp. sensor	All off	Displayed when Error is detected.	1. Check discharge temp sensor (TD) 2. Check P.C. board
		1A	Outdoor fan drive system error	All off	Displayed when Error is detected.	Protective operation of outdoor fan drive system, fan lock, etc.: Replace P.C. board or fan motor,
	Not Displayed	1b	Outdoor heat exchanger temp. sensor error	Operation continues	—————	1. Check outdoor temp. sensor (TO) 2. Check P.C. board
	Outdoor P.C. board	1C	Compressor drive output Error, compressor error (lock, missing etc.), Break down)	All off	Displayed when Error is detected.	After 20 seconds operation, position -detect circuit error occurred: Replace compressor, trouble on P.M.V

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



Next

Self-Diagnosis by remote control - Error code

Block distinction		Operation of diagnosis function				Judgment and action
Check code	Block	Check code	Cause of operation	Air conditioner status	Remarks	
03	Others (including compressor)	07	Return serial signal has been sent when operation Started, but not from half-way 1) Compressor Thermo operation Gas shortage Gas leak 2) Instantaneous power failure	Operation continues	Flashes when trouble is detected on return serial signal and normal status when signal is reset	1. Report start and stop with interval Of approx 10 to 42 mins (Code is not Display during operation): Supply Gas (Also check gas leak) 2. Unit operates normally during check. If return serial signal does not stop between indoor terminal board 2 and 3, replace inverter P.C. board. If signal stops between indoor terminal board 2 and 3, replace indoor P.C. board.
		1d	Compressor does not Rotate (current protective Circuit does not operate when a specified time passed after Compressor had been Activated).	All off	Displayed when Error is detected.	1. Trouble on compressor 2. Trouble on wiring of compressor (miss phase)

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



Next

Self-Diagnosis by remote control - Error code

Block distinction		Operation of diagnosis function				Judgment and action
Check code	Block	Check code	Cause of operation	Air conditioner status	Remarks	
03	Others (including compressor)	1E	Discharge temp. exceed 117°C	All off	Displayed when Error is detected.	1. Check discharge temp. sensor (TD) 2. Gas leak 3. Trouble on P.M.V.
		1F	Break down of compressor	All off	Displayed when Error is detected.	1. Check power voltage (220-230-240 V +10%) 2. Overload operation of refrigeration Cycle: Check installation condition (Short-circuit of outdoor unit diffuser)
		08	4-Way valve inverse error (TC sensor value lowered During heating operation)	Operation continues	—	1. Check 4-way valve operation

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



Next

Self-Diagnosis by remote control



3. Press ON/OFF button to release the service mode.
The display of the remote control returns to as it was before service mode was engaged.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

Failure diagnosis

2.3 Diagnosis using the system symptoms

There are other problems that cannot be detected by the self-diagnostic function and no error codes are displayed. In this case diagnostics should be performed by observing the operational symptoms. Some examples are shown below.

2.3.1 Operation lamp does not blink after power reset

2.3.2 Indoor fan does not operate.

2.3.3 Indoor fan starts to rotate when the Power supply is turned on (DC motor only).

2.3.4 Remote control does not operate.

2.3.5 Outdoor unit does not operate and error code “04” is displayed.

2.3.6 Outdoor unit operation stops 10 minutes to one hour after startup.

2.3.7 General checking of the system components.

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back

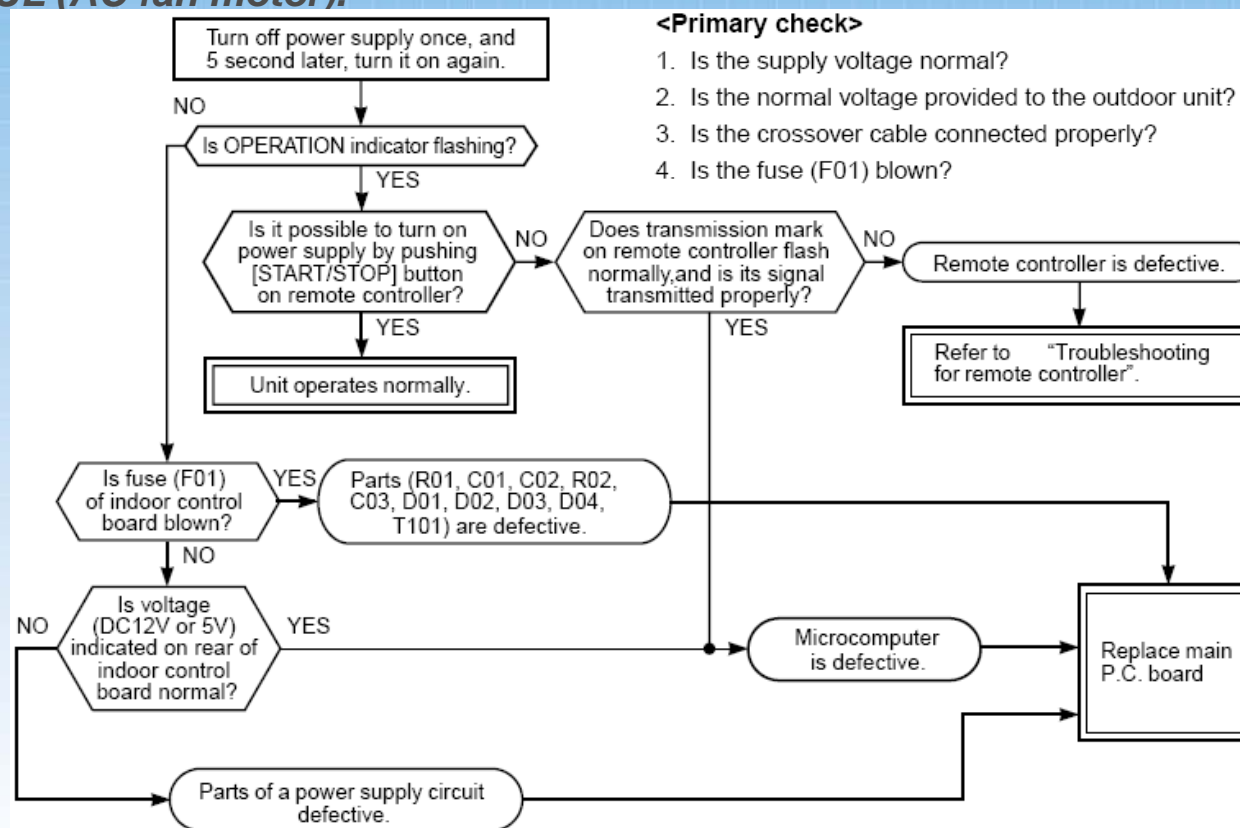


Next

Diagnosis and Possible Action

2.3.1 Operation lamp does not blink after power is reset

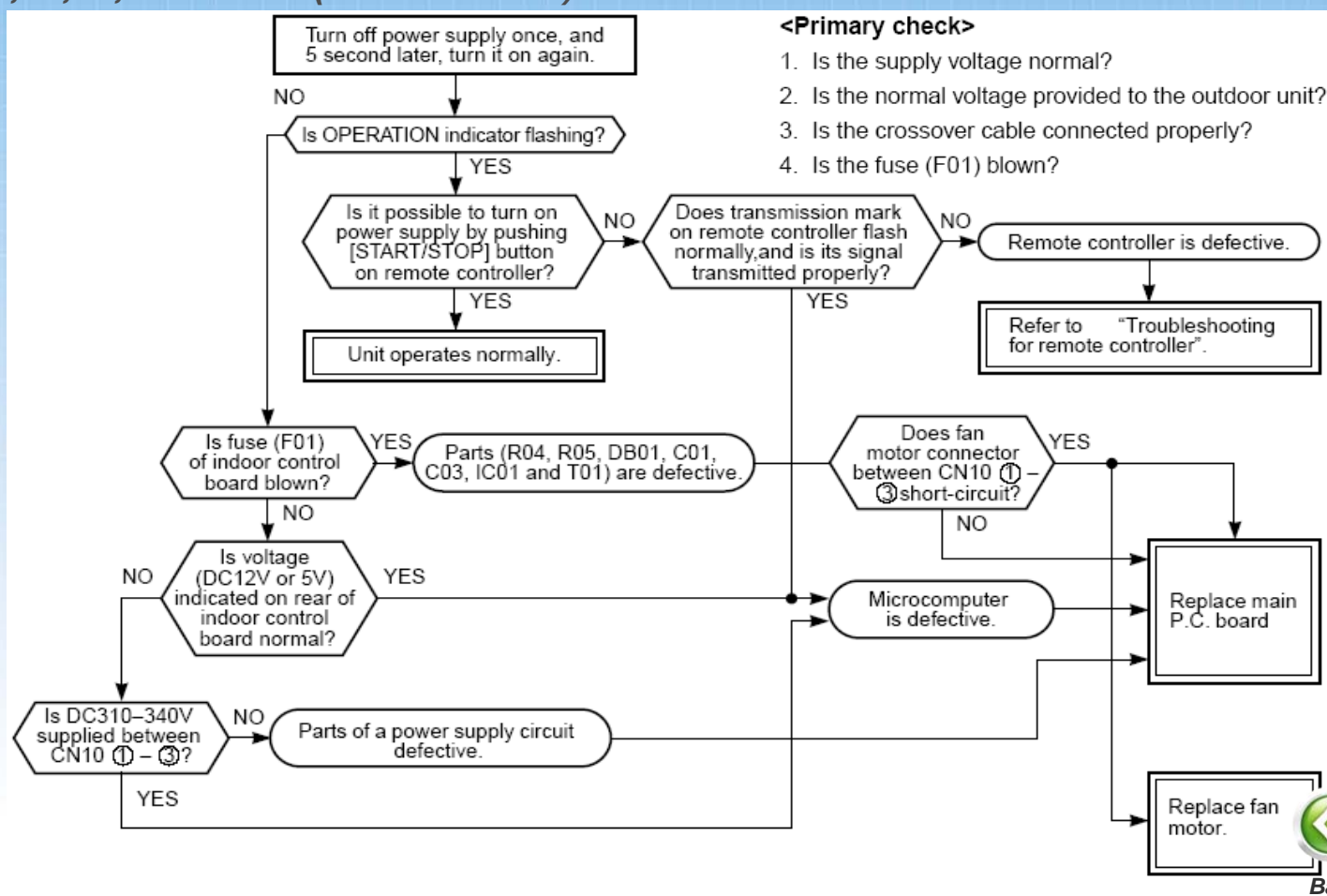
RAS-09LKV-UL (AC fan motor).



Diagnosis and Possible Action

2.3.1 Operation lamp does not blink after power is reset

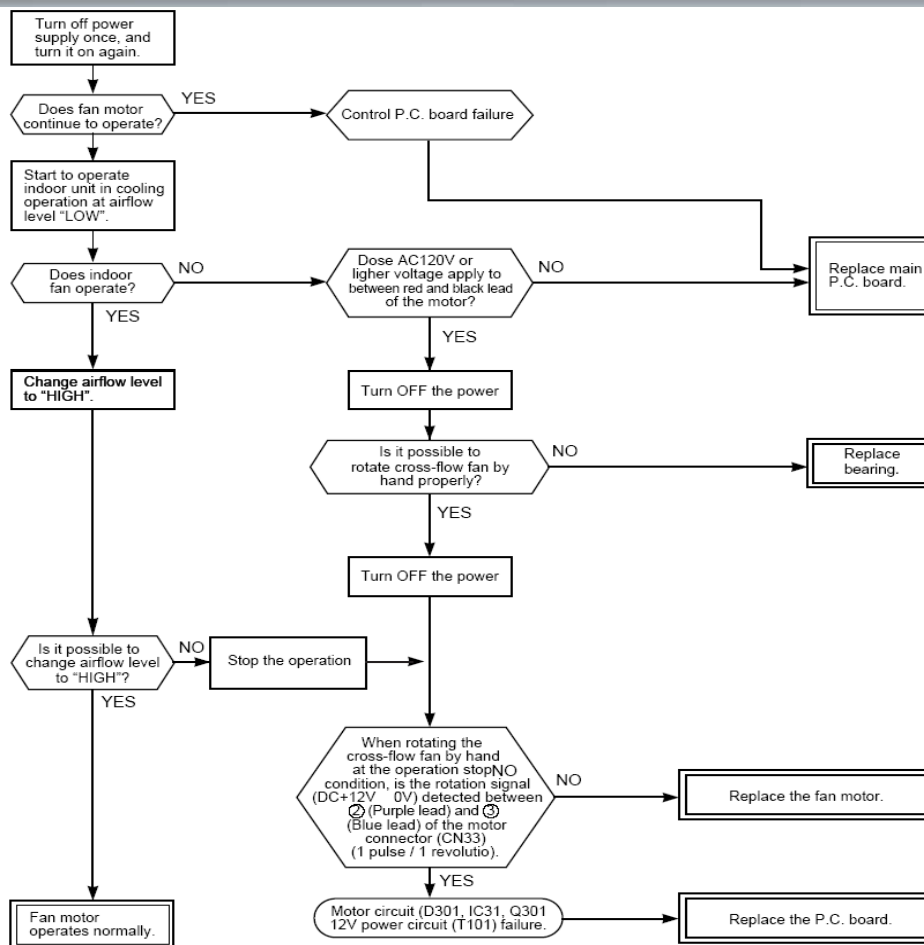
RAS-12,15,17,22LKV-UL (DC fan motor).



Diagnosis and Possible Action

2.3.2 Indoor fan does not operate.

RAS-09LKV-UL (AC fan motor).



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back

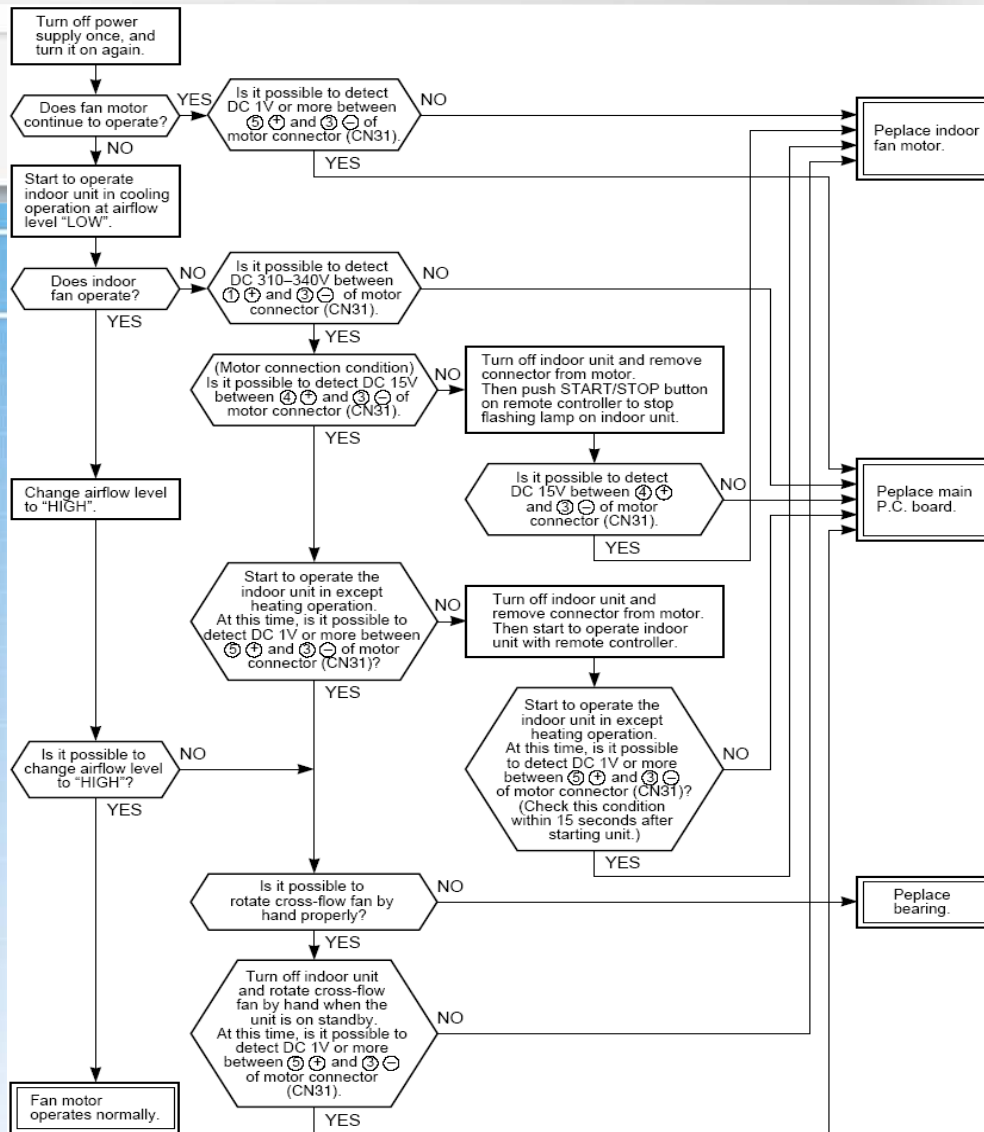


Next

Diagnosis and Possible Action

2.3.2 Indoor fan does not operate.

**RAS-12,15,17,22LKV-UL
(DC fan motor).**



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



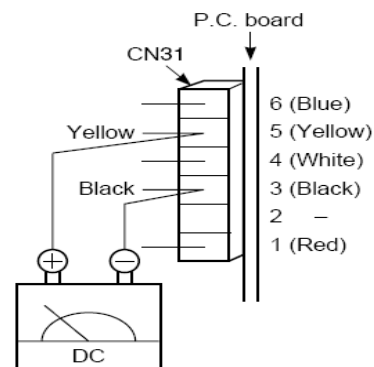
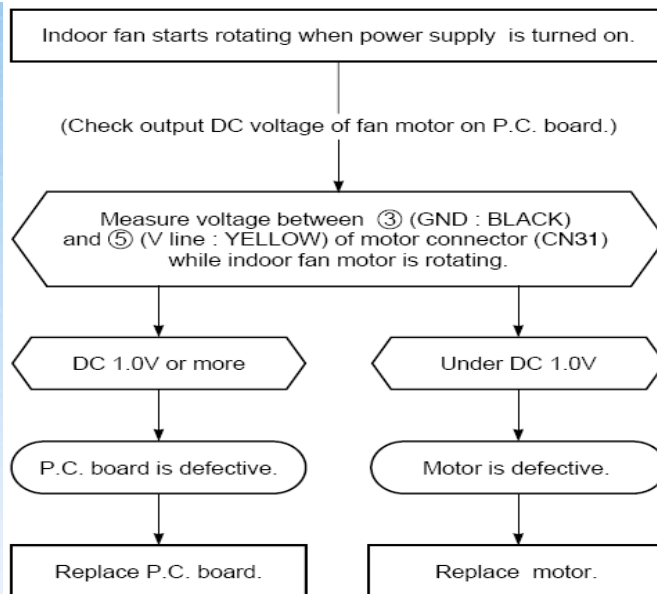
Next

Diagnosis and Possible Action

2.3.3 Indoor fan starts to rotate when power supply is turned ON (DC motor only).

<Cause>

The IC is built in the indoor fan motor. Therefore the P.C. board is also mounted to inside of the motor. If the P.C. board is soldered imperfectly or the IC is defective, the fan motor may automatically rotate by turning on power supply.



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



Next

Diagnosis and Possible Action

2.3.4 Remote control does not operate.

If the remote control cannot operate properly, check whether the batteries have run out or not.

- Press [on/off] button to transmit a signal to AM radio receiver.
- Shoot signal to a digital camera that can detect an infrared signal

Remark : remote control is unable to operate or distorted under these conditions.

1. Radio frequency interference
2. Electronic ballast EMF.
3. Indoor exposed to sunlight
4. lamp
5. A or B setting conflict. (Indoor set B - when the battery is changed, the signal of remote may reverse to A)



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ

Home



Back



Next

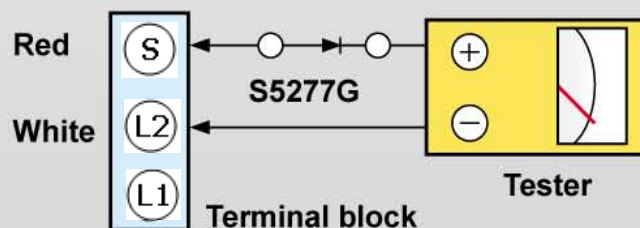
Diagnosis and Possible Action

2.3.5 Outdoor unit does not operate and error code "04" is displayed.

Is the voltage between indoor terminal block L2 and S varied?

(Confirm that transmission from indoor to outdoor is correctly performed based on the following diagram.)

Terminal block on indoor side



Normal time : Voltage swings between DC15V and 60V.

Abnormal time : Voltage does not vary.



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



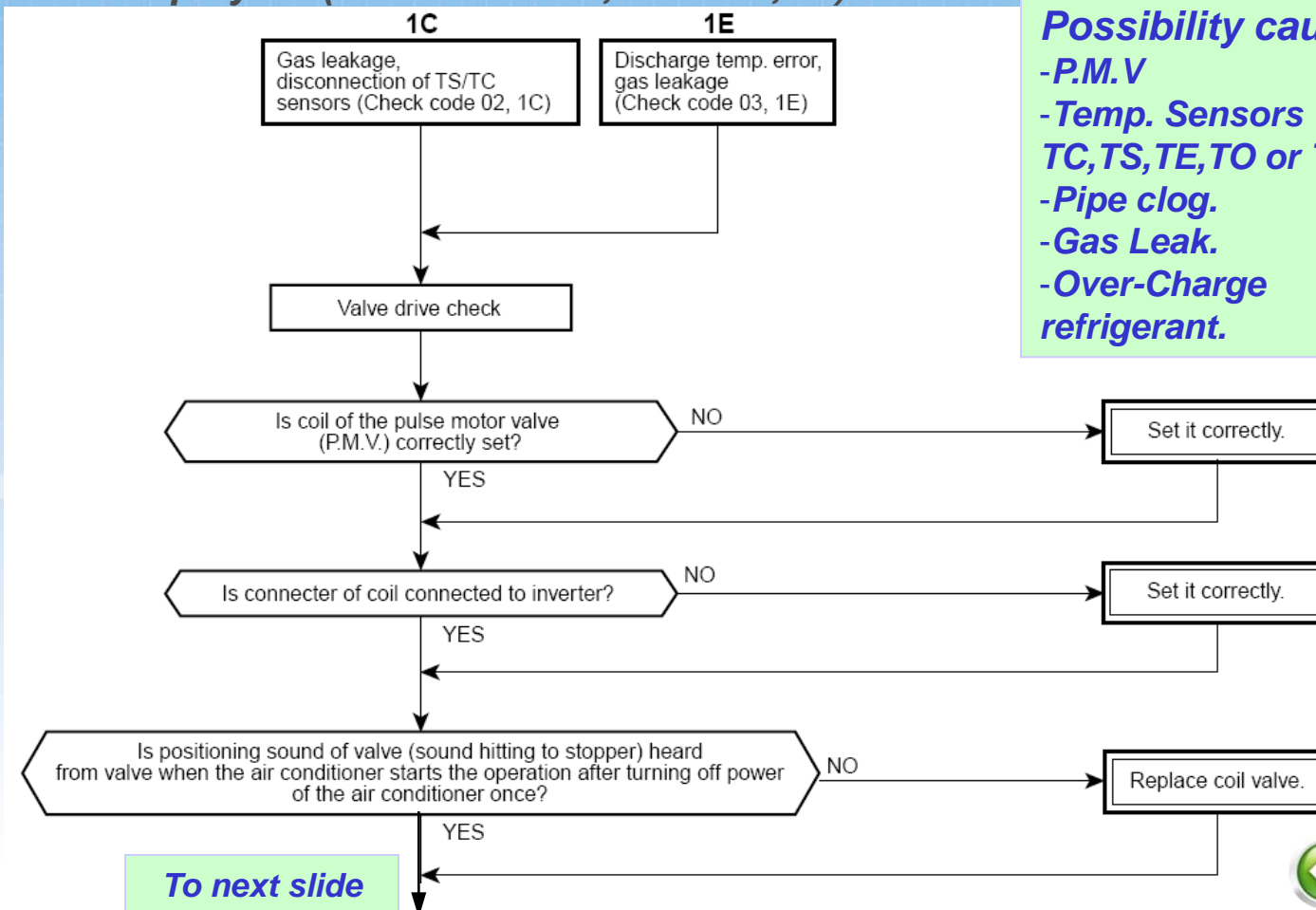
Back



Next

Diagnosis and Possible Action

2.3.6 Outdoor unit operation stops 10 minutes to 1 hour after startup, and an error code is displayed. (Error Code 03,1E or 02,1C).



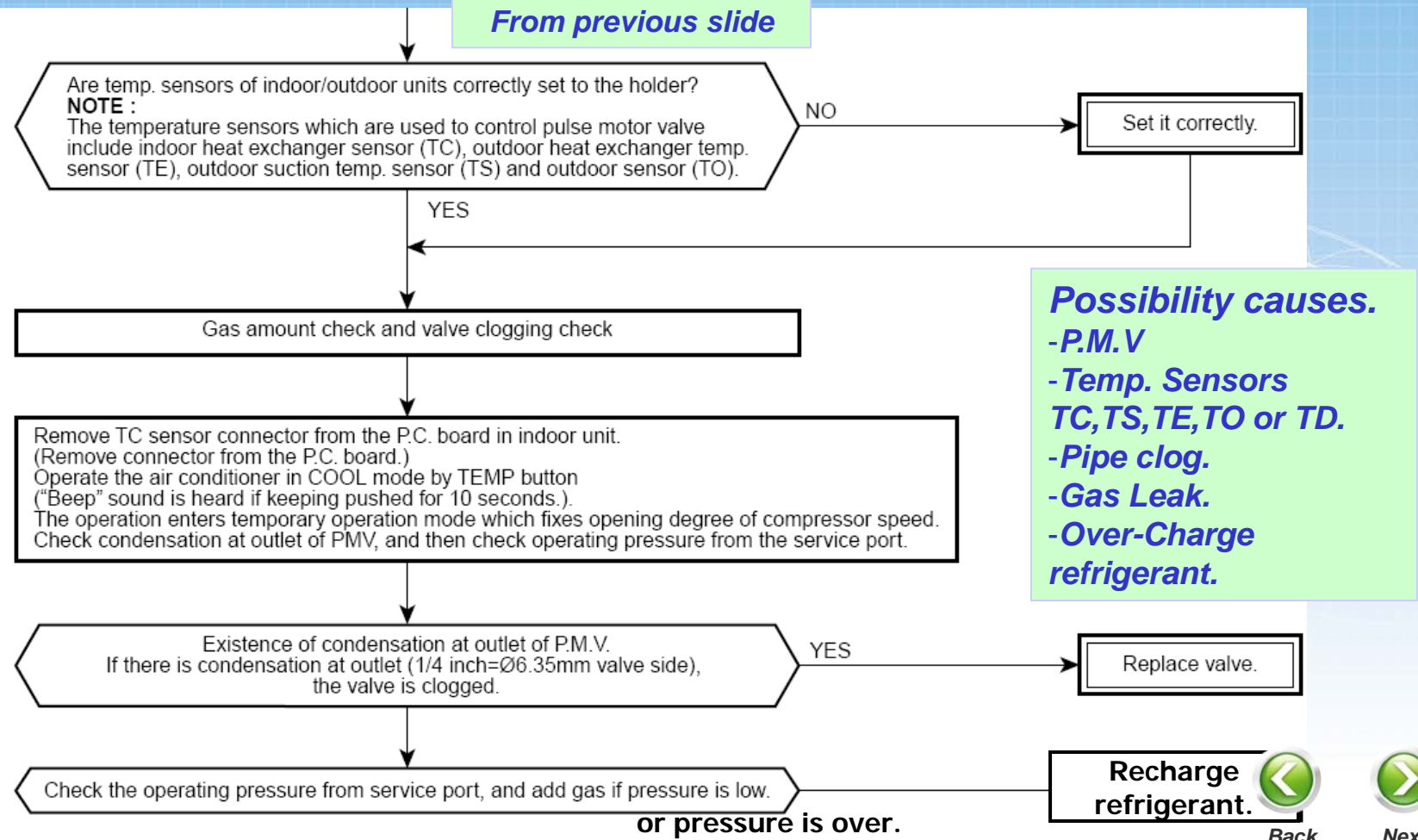
Possibility causes.

- P.M.V
- Temp. Sensors
TC,TS,TE,TO or TD.
- Pipe clog.
- Gas Leak.
- Over-Charge
refrigerant.



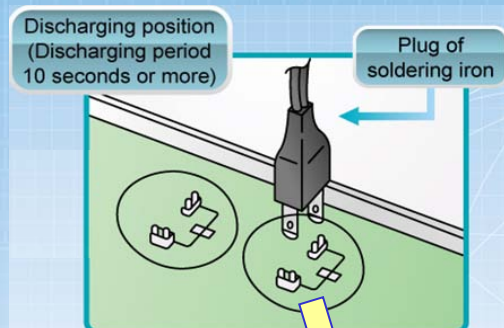
Diagnosis and Possible Action

2.3.6 Outdoor unit operation stops 10 minutes to 1 hour after startup, and an error code is displayed. (Error Code 03,1E or 02,1C).

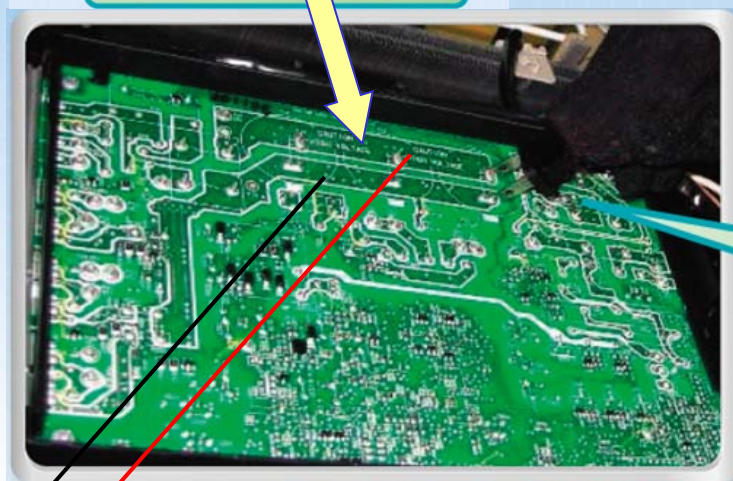


Diagnosis and Possible Action

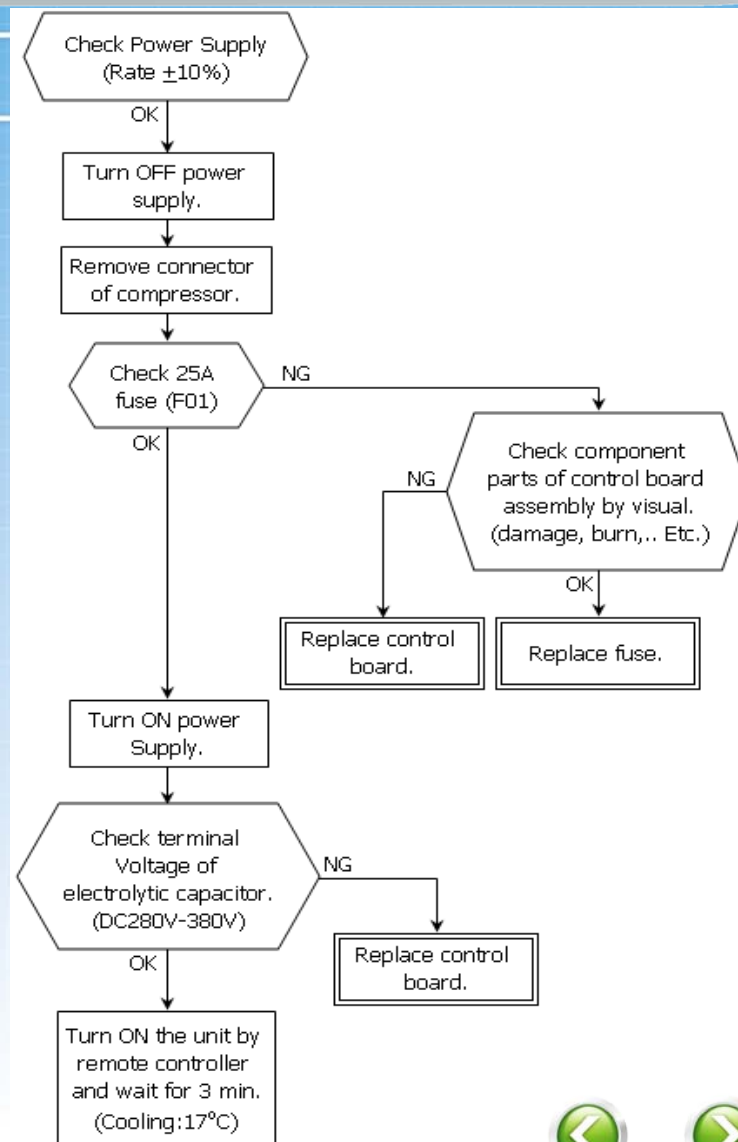
2.3.7 Overall checking for Inverter Assembly, compressor and outdoor fan.



CAUTION : To Discharge capacitor before checking fuse.



DC 280V-380V



To next slide



Home



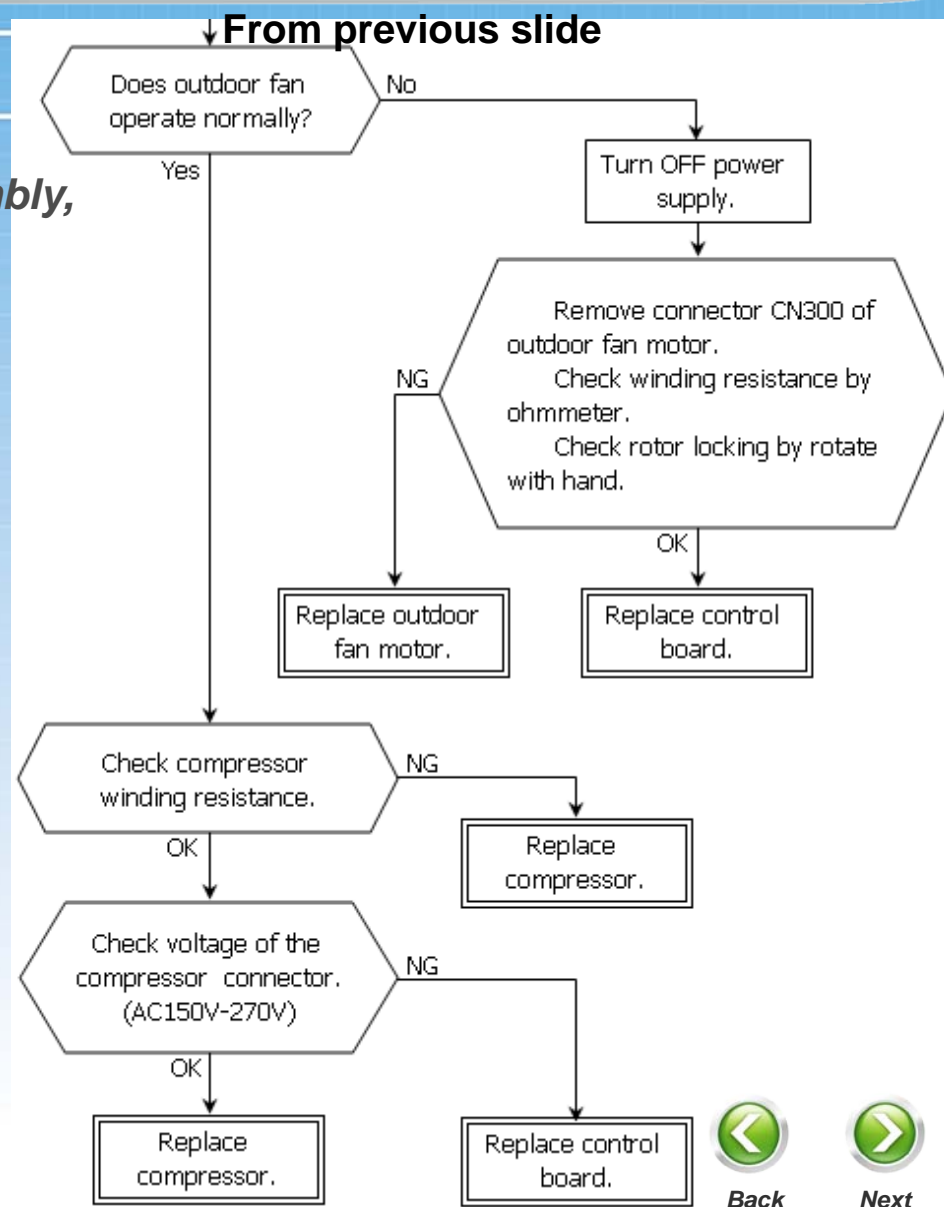
Back



Next

Diagnosis and Possible Action

2.3.7 Overall checking for Inverter Assembly, compressor and outdoor fan.



How to check the main parts

1. Compressor

Checking compressor can be done by measuring the resistance value of the winding which is the same for all 3 poles.

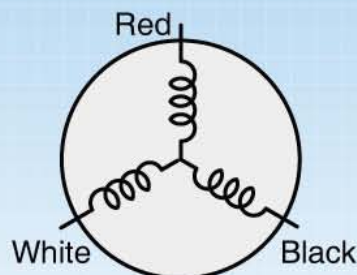
Checking procedure

Measure the resistance value of each winding by using the tester

Compressor

Model DA111A1F-20F1
~ 16SACVX-T

Model DA89X1C-23FZ
~ 10SACVX-T, 13SACVX-T



Position	Resistance value	
	DA111A1F-20F1	DA89X1C-1F-23FZ
Red - White	0.88 to 0.98 Ω	1.04 to 1.16 Ω
White - Black		
Black - Red		

Under 20°C

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back



Next

How to check the main parts

2. Outdoor Fan Motor (DC type)

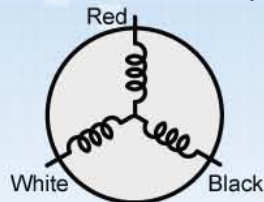
Checking DC Fan motor of outdoor unit can be done by measuring resistance value of the winding (same as compressor).

Resistance value in the table is the value when winding temperature is 20°C (20-22 Ω) for other condition the resistance value should be in a range between 17-25 Ω)

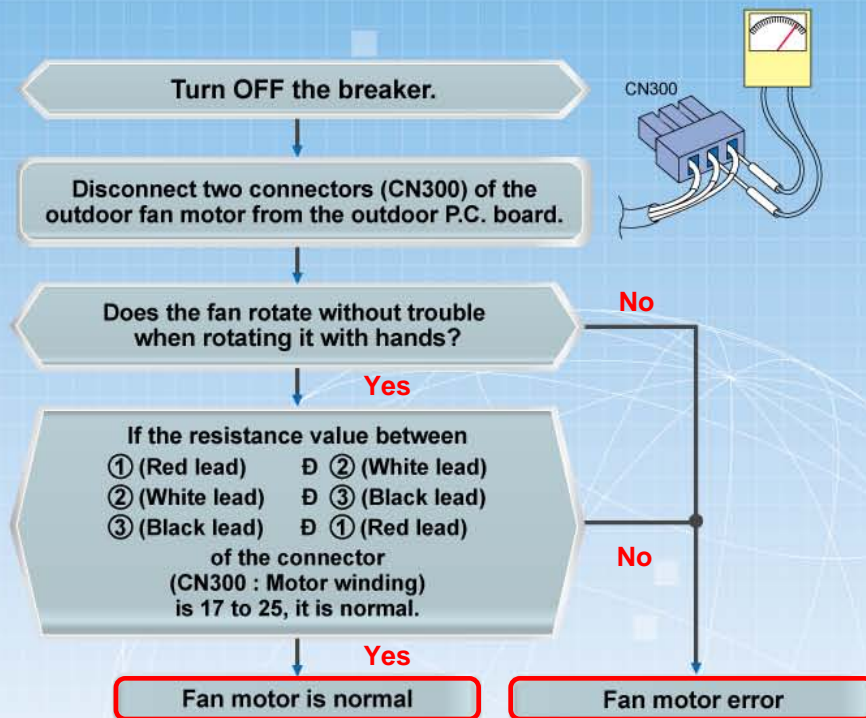
Checking procedure

Measure the resistance value of each winding by using the tester

Outdoor fan motor (Model : ICF-140-43-4R)



Position	Resistance value
Red - White	20 to 22 Ω
White - Black	20 to 22 Ω
Black - Red	20 to 22 Ω

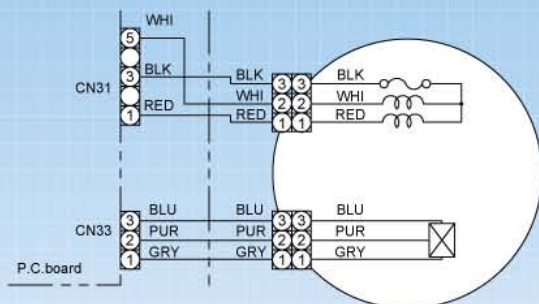


How to check the main parts

3. Indoor Fan Motor & Louver Motor

1. Do not disconnect the connector while the fan motor is rotating.
2. Check the resistance value in case that indoor fan motor or louver motor per details below

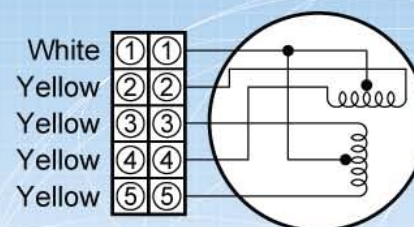
Indoor Fan Motor AC, AFS-220-20-4R



Position (P.C. board)	Resistance value
Between ③ (Black) - ① (Red)	$74 \pm 15 \Omega$
Between ③ (Black) - ⑤ (White)	$100 \pm 20 \Omega$
Between ① (Red) - ⑤ (White)	$174 \pm 35 \Omega$

Louver Motor MP24Z 3T

Measure the resistance value of each winding by using the tester (under normal temp. 25°C) Louver Motor MP24Z 3T



Position	Resistance value
1 to 2 1 to 3 1 to 4 1 to 5	$250 \pm 20 \Omega$

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



Next

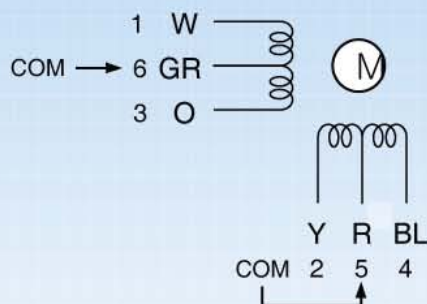
How to check simply main parts

4. Pulse Motor Valve Coil

Checking procedure

Measure the resistance value of each winding by using the tester

Pulse motor valve coil (Model : C12A-01-R)



Position	Resistance value
Grey - White	43 to 49 Ω
Grey- Orange	43 to 49 Ω
Red- Yellow	43 to 49 Ω
Red- Blue	43 to 49 Ω

Under 20°C

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ



Home



Back

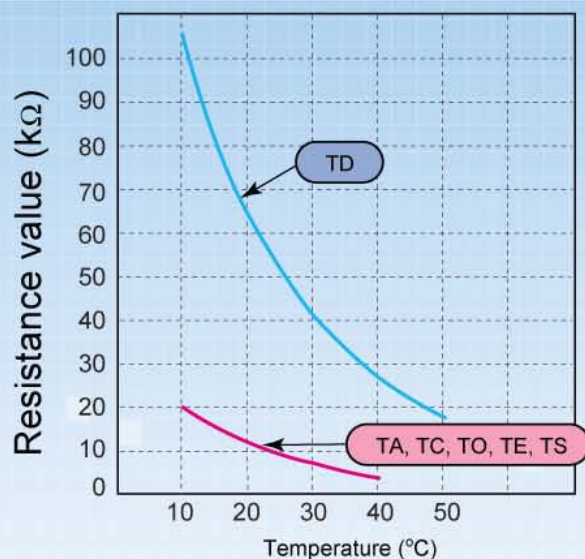


Next

How to check the main parts

5. Temperature sensors.

Sensor characteristic table



Disconnect the connector, and measure resistance value with the tester. (Normal temperature)

Sensor \ Temperature	10°C	20°C	25°C	30°C	40°C	50°C
TD (k Ω)	100	64	50	41	27	18
TA, TC, TO, TS, TE (k Ω)	20.7	12.6	10.0	7.9	4.5	—

- TD : Discharge temp. sensor
- TA : Room temp. sensor
- TC : Heat exchanger temp. sensor
- TO : Outdoor temp. sensor
- TE : Outdoor heat exchanger temp. sensor
- TS : Suction temp. sensor

Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back

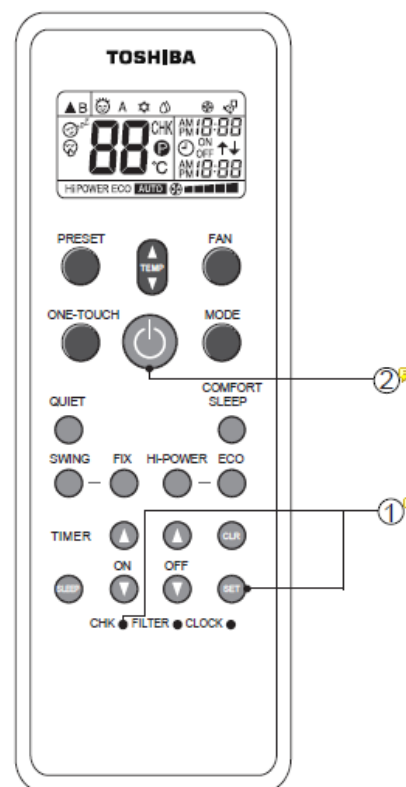


Next

How to bypass restart delay timer

9-7-2. How to shorten time of restart delay timer

- ① Press [SET] button while pressing [CHECK] button with a tip of a pencil.
- ② Then press [ON] button to transmit the signal to the indoor unit.



Introduction

Installation

User Training

Operation

Services

Case Study
& FAQ


Home



Back



Next

How to check the main parts – indoor board

Topic	Procedure	Check point (Symptom)	Cause
1 Check main part of Power supply circuit	Shutoff the power supply	1. Is the Fuse F01 blown? 2. Is the R64 opencircuit?	1. Application of shock voltage.
2 Check Power supply circuit	Remove the connector for the motor, and turn the power on. If the OPERATION lamp blinks (0.5 sec. : ON, 0.5 sec. : OFF) when the power turning on, the checking points described as 1-4 of right column are not necessary to perform.	Voltage check 1. Between F01 and CN01(pin 1) (AC 208 ~ 230 V) 2. Between + and - of C27 DC294-DC325V 3. Between 5V and GND 4. Between 12V and GND	1. AC power cord is defective. Poor contact of the terminal plate. 2. Line filter (L01) is defective. Capacitor (C27) is defective. Bridge diode (DB01) is defective. 3. IC01 or T01 or IC02 is defective. 4. IC01 or T01 or C32 is defective.
3 Check LED Lamp	Start the operation with shorten delay time.	1. All indicators light for 3 sec.. 2. Indicators indicate normally after approximate 3 sec.	Defective indicator, or poor housing assembly. (CN20)
4 Check Fan-motor Drive circuit	Turn the power on after connecting the motor connector. Start the operation with the following condition. 1.Operation [Cooling] 2. Airflow [High fan]	1.Motor does not rotate. (The key operation is accepted.) 2. The Motor rotates, but it vibrates too much. 3. Motor is rotate with max-speed 10 Second and stop 10 Second 2 cycle.	1. Poor contact of the motor connector. 2. Fan motor is defective. 3. Fan motor drive circuit out of function.
5 Check output of Serial communication	Push [START/STOP] button once to start the unit. (Do not set the mode to On-Timer operation.)	Check power supply voltage : 1. Between CN51 and No. 1 of CN01 (DC 15-60V)	IC51 and IC52 are defective.
6 Check sensor detection.	Make the operation status by 1. The time of the restart delay timer is shortened. 2.Cool operation 3.Make the setting temperature lower enough than room temperature.	1. Compressor does not operate. 2. OPERATION lamp blinks.	1. The Ambient temperature sensor (TA) broken or connector CN61 loose. 2. The Heat Exchange sensor(TC) broken or connector CN62 loose. 3.Main P.C. board is defective.



TOSHIBA
Carrier



Thank you very much.